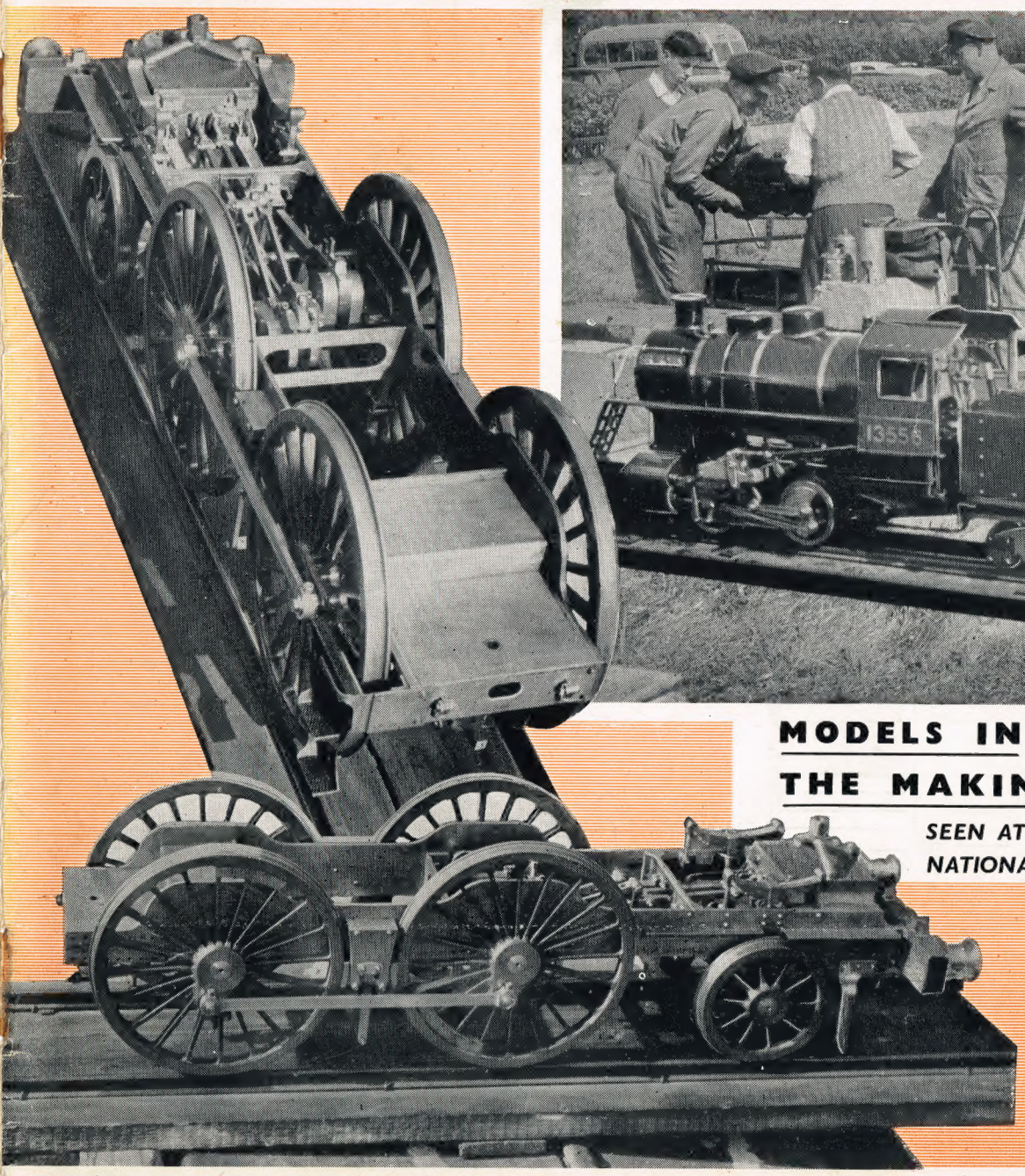
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



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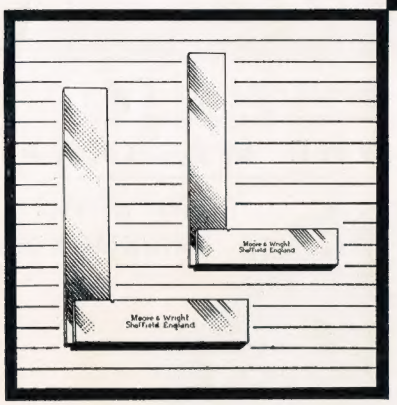

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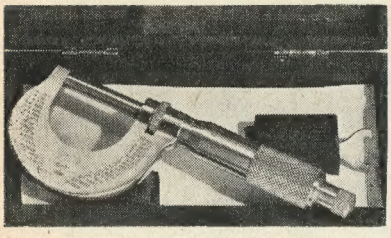

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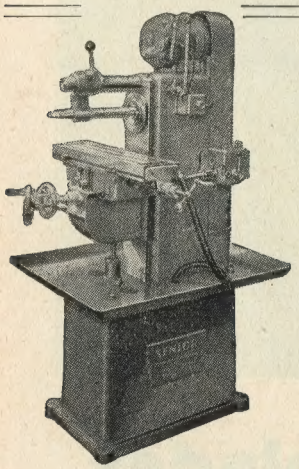

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Model Engineer

ONE SHILLING 14 NOVEMBER 1957 VOL. 117 NO 2947

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Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

THE oldest car ever to participate in the London to Brighton Veteran Car Run chugged along with the 235 other vintage entrants—a record, by the way—in this year's event.

The car, an 1888 1½ h.p. Rogier Benz, is the oldest petrol-driven car in the country and the fifth eldest commercially produced car in the world.

A three-wheeler, it is regarded by the Science Museum, who entered it in the run, as the most historically important item in their National Road Transport Collection, and was purchased as long ago as 1913.

The mechanism and coachwork were completely restored in the museum's workshop.

The car was driven by Mr C. F. Caunter, head of the Road Transport Collections, and his mechanic was Mr W. G. Glawith, deputy foreman of the museum's metal working shop.

Unfortunately it withdrew from the race after a collision in Purley.

The right idea

IT is not often that a bureaucratic institution shows a progressive spirit but I am pleased to see that, in one respect at least, the British Transport Commission does.

For the benefit of transport students and research workers their Historical Records Collection, housed at 66 Porchester Terrace, London, W2, has remained open until 8.30 p.m. on Tuesdays, normal closing time being 4.30 p.m.

But students have been flocking to the Collection so enthusiastically on Tuesday evenings that the Commission has decided that it should remain open late for another evening, namely Thursday.

As a measure of the public's interest in transport affairs it is interesting to note that over 5,000 inquiries have been lodged at the repository since the records were made available in 1951.

Eureka clock

"YEARS Ahead of its Time," the article by B. S. T. Wallace on the subject of the Eureka clock, struck a familiar chord with T. Tinson, of Strensall, York, for his father owns a Eureka battery-driven clock with the numbers 7905, Patent No 14614, 1906 stamped on the front.

The Tinsons always believed that the last number referred to the year of manufacture but according to Wallace's article manufacture did not begin until 1909.

"We have had this clock for 20 years," writes Mr Tinson. "It runs approximately six months on a spent twin-cell cycle battery."

Young inquirers

MY paragraph [ME, October 10] about a lathe which a North of England reader will give away to an enterprising youthful model engineer drew a heavy response.

Smoke Rings . . .

I have been very busy sorting through the replies, several of which were from young lads of 12 to 14 engaged on such ambitious projects as steam engines, locomotives and ships, and it will take a little while before a decision is reached.

However, I would like to assure all those who inquired that every letter will be given very careful consideration and the name of the lucky youngster will be published as soon as possible.

Winking indicators—

A READER wrote to the Query Service of MODEL ENGINEER stating that he contemplated fitting winking indicators to his pedal cycle. He wanted to know whether it would be legal and what the regulations were.

The question was put to the Ministry of Transport and I was interested to read their reply:

"Direction indicators which are fitted to *motor* vehicles must comply with the Schedule to the Motor Vehicles (Construction and Use) (Amendment) Regulations, 1955, (S.I. 1957 No. 359) obtainable at 6d. net from H.M. Stationery Office or any bookseller. There are no similar requirements for pedal cycles and there would seem to be no legal objection to the fitting of such devices on pedal cycles.

—for a bicycle

"In the Department's opinion, however, pedal cycles are not suitable machines for the fitting of direction indicators of the type you have in mind. Owing to the narrow width of pedal cycles, direction indicators on the front and back would have to be fitted close together and this could well confuse other road users and, in fact, prove dangerous. For instance, a motorist, driving at night-time, could easily mistake the off-side signal for the near-side signal, with unfortunate results.

"On the other hand, it is considered that pedal cyclists should do all they can to ensure that at night-time they and their machines are as conspicuous as possible and that their signals are clearly visible. Various devices, including white gauntlets or armlets, are helpful in this respect.

"If your subscriber decides to use the device, it is suggested that he obtains a copy of the Regulations quote above, and endeavours to make the indicators comply as far as possible with the specification contained in the Schedule, but the Department's advice is that it would be preferable to follow the advice laid down in the Highway Code (e.g. paragraph 47)."

The next move is with the reader and I am sure that everybody will want to know whether he goes ahead with his plan.

Cover picture

Bill Finch, of Birmingham, has so far spent seven years on the chassis of his North Western 2-4-0. *It has Allan straight-link valve gear, faithfully following the prototype's inclined valve faces. The American switcher is a freelance design in 5 in. gauge built by A. Castle, of Worcester. It has three cylinders with Baker valve gear, the inner valve being operated by Gresley two-to-one motion. It still awaits bell, headlamp and donkey pump. These models were on show at the Birmingham National Rally, a report of which appears on pages* 682 *and* 683.

George Stephenson's INVICTA, *presented to the City of Canterbury in* 1906. *It drew the first train on the Canterbury and Whitstable Railway, was transferred to the SER and was eventually presented to its directors by Sir David Salamons*

Steeling the picture!

THOSE gremlins have been at work on me. Or is it that the startling and exciting news of the first man-made satellites has disturbed my journalistic rhythm?

Whatever the reason, H. V. Steele and Ian Steels must be quietly chuckling at my expense for in a moment of aberration in Smoke Rings of October 17 I unwittingly captioned a photograph of the former with the name of the latter—though the error must have been obvious to the reader.

"Indeed," H. V. Steele tells me in a letter, "you pay me a compliment in attributing the model to Ian Steels. These little mistakes will creep in, and it could have been worse. You might have printed Tommy Steele."

Theme for a workshop . . .

with incidental musing by J. NIXON

I LIVE in a hamlet on the southern shore of the Moray Firth, many miles from any centre of engineering activity which might be expected to create an aura of interest in things mechanical.

The inhabitants of the surrounding countryside are either fishermen or farmers, or else their business is associated with these basic industries. Of course, most of the things in modern life have a clearly recognisable association with these engineer's profession—a fact which seems to be borne out by the interest displayed by visitors, no matter what their sex or calling, in the contents of the building which *en famille* is somewhat flippantly referred to as " The Workhus."

Speaking for myself, as a professional engineer, any sort of workshop, commercial or private, will contain something of interest. The organised factory, with its machines deployed and operated on a level of high efficiency by an army of people working as a team, can be awe-inspiring, and a visit to such a plant can make one feel very insignificant and humble.

The private workshop, on the other hand, probably for the reason that one is able to bring it into focus more easily, does not leave one with such depressing thoughts, and within its narrower confines it can be just as much a manifestation of the ingenuity of man as the largest plant.

The home " shop " run by one man for his relaxation and pleasure has always aroused the liveliest curiosity in me, and while nowadays I could remain calm at the prospect of a visit to some vast, noisy factory, I would still go a long way to see some other fellow's one horsepower shack.

My own workshop is a reasonably simple building constructed of 18 in. × 9 in. × 4½ in. concrete blocks, 20 ft in length and 11 ft 6 in. in breadth. The floor is of concrete, and the roof of wood overlaid with corrugated asbestos sheets.

Apertures are kept to a minimum in deference to the somewhat draughty weather which is a feature of North Scotland. There is, of course, a door, one small ventilator window facing north, and two rooflights of corrugated Perspex which provide most of the natural lighting. The window faces the house, some 30 ft away, and with the aid of an electrically-operated buzzer and sign language, contact is maintained with the household which can be useful in times of emergency —mealtimes, for instance !

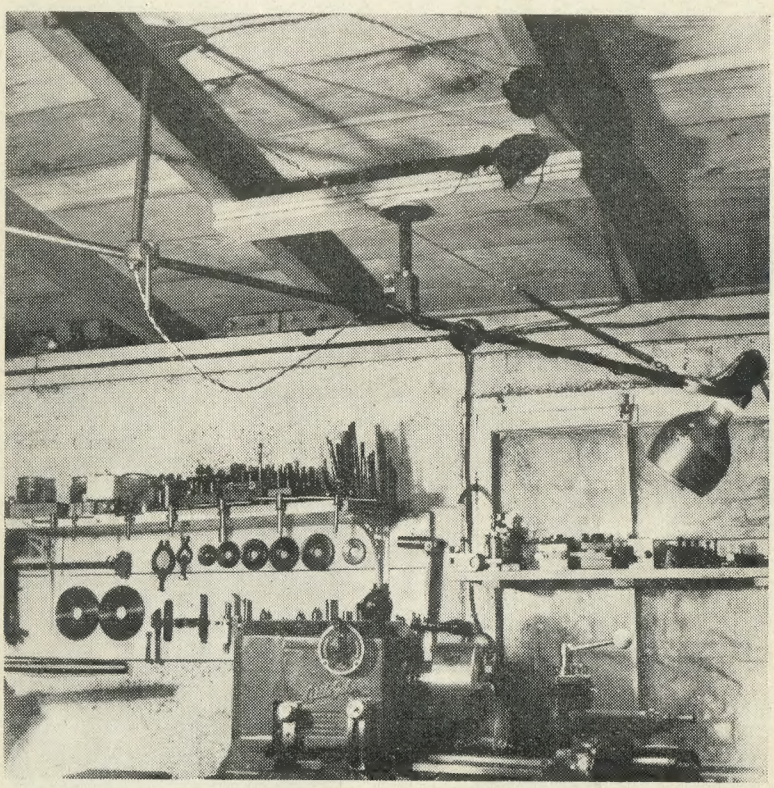
On completion the place resembled all concrete structures, a little drab and rough, rather cold looking, but otherwise sound and strong.

Disillusionment came with the first October rains, however. Moisture on the inner wall rapidly became small rivulets which impishly converged and merged into shallow pools along the base of the walls—definitely a depressing state of affairs ! When the weather improved—we call it summer here just to be in the fashion—the walls got a thick coat of harling outside, since when there has been no cause to complain.

LAYOUT

The machine and vice benches are all of timber: 3 in. × 3 in. pine supports; 2 in. oak planks are situated under the heavy machines and the main vice bench is 10 in. × 2 in. larch. The back portions of the benches are just ½ in. decking with packing to bring it up to the level of the oak. All the supports are anchored to the walls and floor by means of angle brackets, Rawlplugs and coach bolts.

About 12 in. under the top deck is a second deck supported on a cross bar, and this one carries an immense amount of junk and stock. Most of the heavy bar stock is stored immediately below the Littlejohn, helping still further to keep its feet on the ground. A considerable part of this latter material consists of bars of from ⅞ in. to 1½ in. dia. picked up in



A part of the north wall

Theme for a workshop . . .

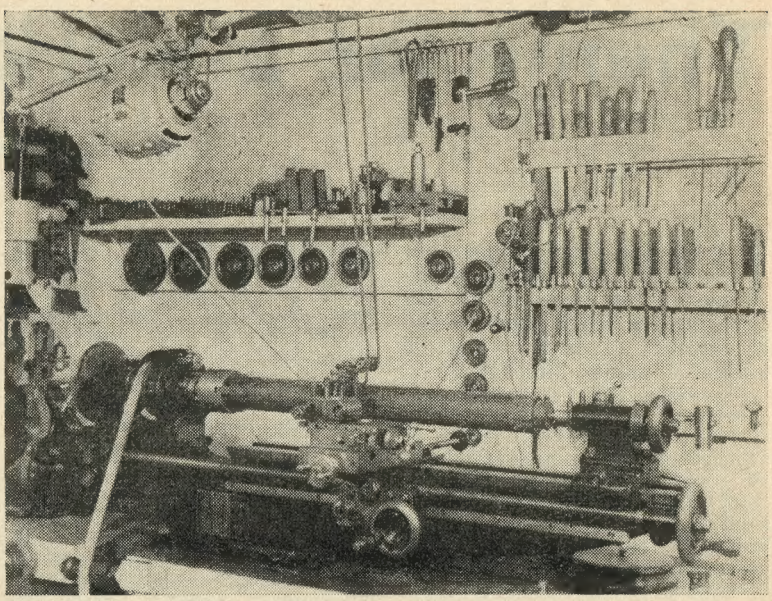
garages, mainly worn or damaged steering rods and half-shafts. (Garage proprietors, in this part of the country, at least, are glad to get rid of the stuff.) These shafts are usually of good quality high tensile steel with which it is a pleasure to work.

HEATING

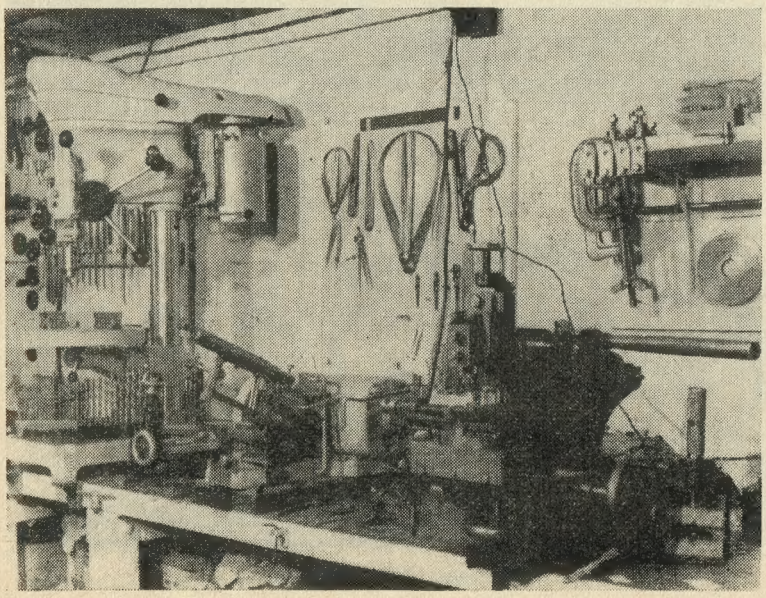
There is none. I dislike it as a practical proposition for several reasons. For one thing heating has to be continuous if condensation with all its attendant evils is to be avoided, and continuous heat of any sort costs money; moreover, it has to be maintained and serviced, which at best means time and trouble.

Therefore, as the temperature falls, I put on corresponding extra layers of wool. Actually, the concrete keeps the place warmer in the cold weather and, conversely, cooler in the warm weather by about 10 to 15 deg. F. A sudden rise of temperature after a cold spell is the only cause for real panic, as vapour from the atmosphere condenses on the cold machines and turns them into clammy, red horrors. Of course, all this can be avoided if the machines are smothered in oil and swaddled in coverings and casings and the like, but this sort of thing presents a problem in itself in that the machines have to be uncovered and unswaddled before one can use them.

To me the whole problem remains without an entirely satisfactory solution on a practical basis, but in the months when adverse conditions might be expected, I try to keep exposed bright work covered with a *smear* of rust-preventive oil, plus a nightly drape over each machine. These drapes, by the way, are condemned window curtains.



Above and below: Two mor sections of the north wall



MACHINERY

As in all workshops, the lathe is the centre piece. Mine is a 5 in. Littlejohn.

In my early days I was quite happy to pedal away at a round bed Drummond by the light of the humble candle when the meagre natural light from a dormer window failed. It is one of the ironies of life that the more one lives and works with something, the more critical and dissatisfied one becomes until a further refinement is attained.

To be able to start the lathe and keep it working for an indefinite period without having to change feet or call a spell, and to call into being powerful, dazzling light, all of 40 w., with a flick of the finger, sounds like an engineer's paradise after the candle and pedal ! But it isn't really very long before one casts a liverish eye on the miserable 40 w. bulb and decides that a 60 w. is a much better light, which doesn't really affect the electric bill by such a devastating amount. And so it goes on. The ultimate development in my case: a 150 w. Crompton shaped exactly like an infra-red lamp; it is fitted with a mask embodying a focusing tube in its centre which throws a powerful, concentrated disc of light, no more than about 9 in. dia. on to the work with no glare from the lamp itself.

In service the lamp mask becomes very hot and one has to be careful to avoid it or else to wear some form of protection on the head.

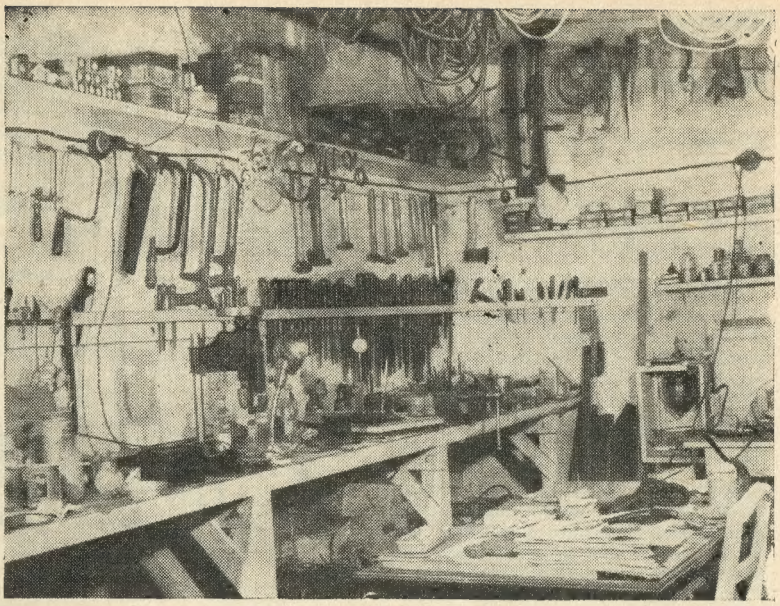
The fittings give the lamp very great flexibility and a large radius of

action. The backstay consists of brass dog chain, which is adjustable, and a spring which once formed an important part of the internal economy of a roller blind. This rig gives the mounting flexibility in a vertical sense and also acts as a safety stop—the bulb will set one back 18s. 6d. if one is careless or unlucky.

The whole mounting can be knocked up practically from the scrap box in an hour or two. The lamp, holder, mask, forked bracket and certain other fittings are supplied as a set by the makers. The lamp, with its large radius of action, can be positioned to light the Littlejohn, shaper, light filing bench, grinder bench, brazing hearth and desk.

I find this lamp particularly useful when boring blind holes as it can be set to throw a beam into the bottom of a bore without itself getting in the way of the operation.

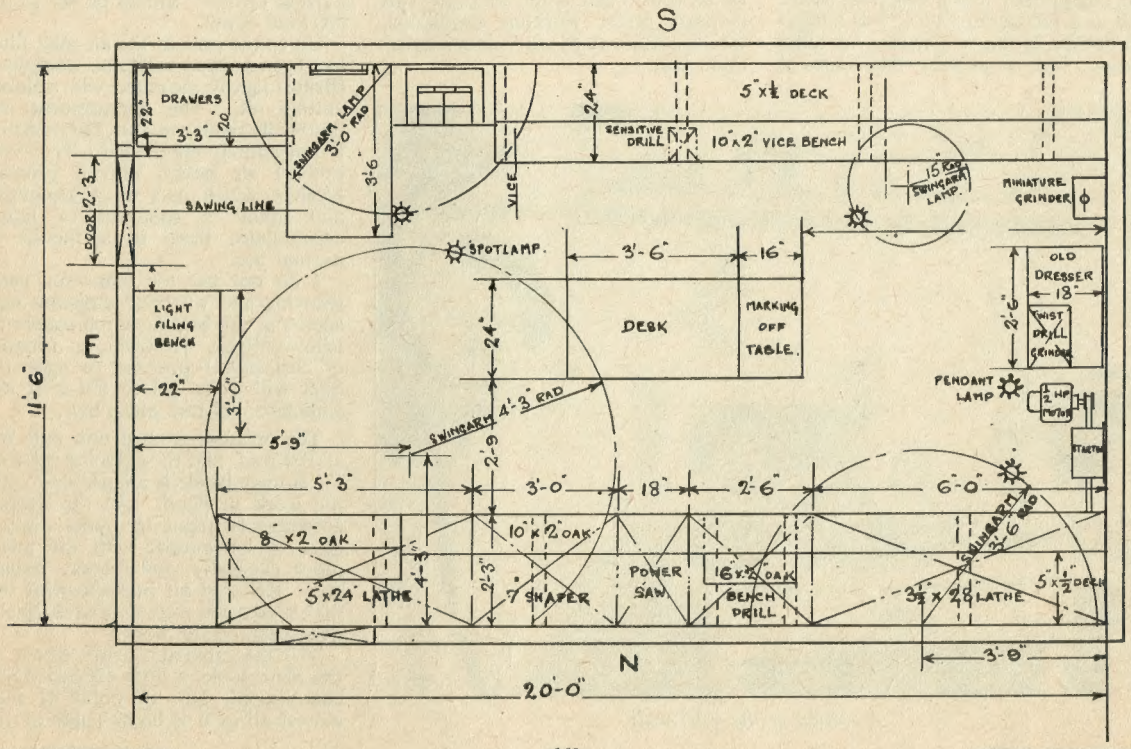
Three of the remaining light fittings (there are seven in all) are composed of old gas brackets from a previous age. A hole is drilled through the burner end for twin flex, while a spring clothes peg clipped to the flex above the pipe end provides a means of height adjustment. Another of the the fittings is a short "rubber neck" desk lamp, which is used mainly on the marking-off table, where a particularly low set light is necessary when setting the scribing-block pointer to a vertical steel rule.



Above: Part of the south wall. Below: Plan of the workshop

The shelf which can be seen across the hinge of the window is strictly toolpost territory, while that to the left carries the teeth for the lathe—milling cutters reamers and spare lathe tools. On the edge of the same shelf all chuck keys are mounted in clips, and on the facia board underneath are disposed boring bars, gear wheels, centres and certain other accessories.

The lathe is set at an angle to the line of the bench so that full advantage can be taken of the hollow mandrel,

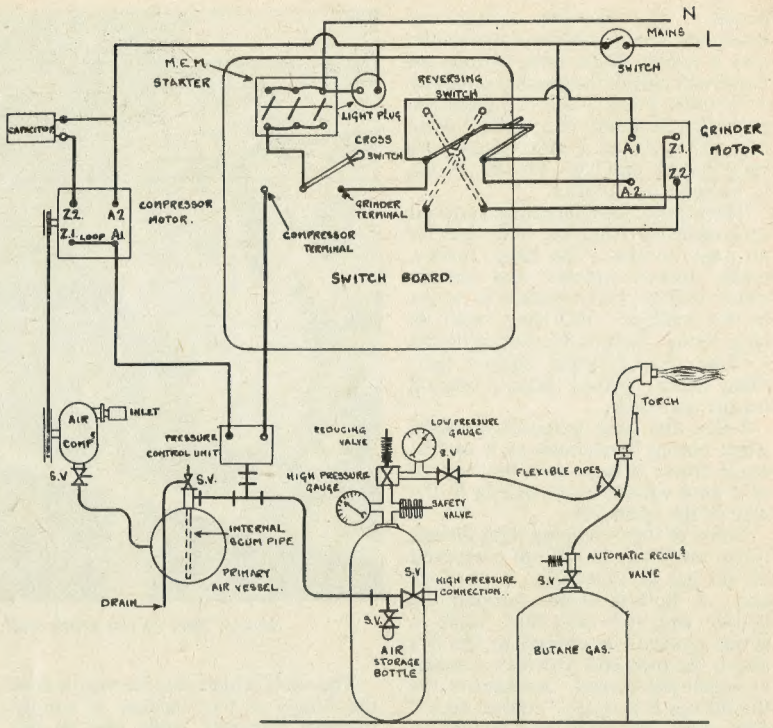


the angle being such that a long rod can be supported from the vertical slide of the shaper.

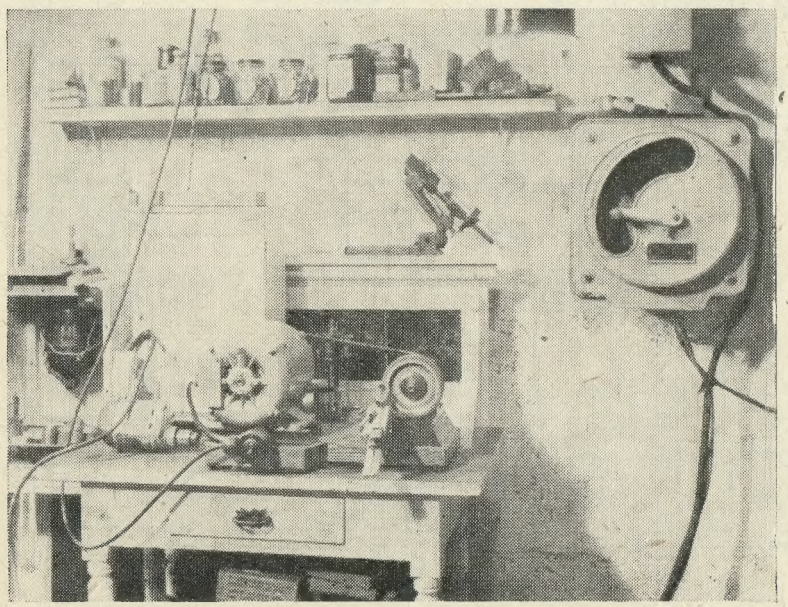
POCKET POWER STATION

The bench comprises quite a galaxy of essential services. The main grinder motor (½ h.p.) runs at 2,850 r.p.m. and mounts an 8 in. medium grit wheel, which, being the finishing stone, is maintained with great care. The tool grinding jig is mounted at the side of the wheel. A V-pulley between the wheel and the motor drives an M-belt connecting it to a combination machine consisting of a 6 in. coarse grit grinding wheel, a chuck which will take suitably mounted sanding discs, wire brushes and burrs, and, at the opposite end, the spindle is taper-screwed to accommodate polishing brushes, buffs and mops.

A 6 in. circular saw and table can be substituted for the coarse wheel, and, as this is in direct line with the door, long pieces of timber can be handled without knocking down a wall. On the deck below another ½ h.p. motor drives a twin-cylinder air compressor which began its active life as a refrigerator unit; it is alleged to deliver 2½ cu. ft per min. at 1,000 r.p.m., but to achieve this figure it certainly needs more horses; 500-600 r.p.m. is as much as the ½ h.p. job can manage under working conditions, which require it to start under maximum load.



Wiring diagram and diagrammatic arrangement of the brazing plant



A section of the west wall

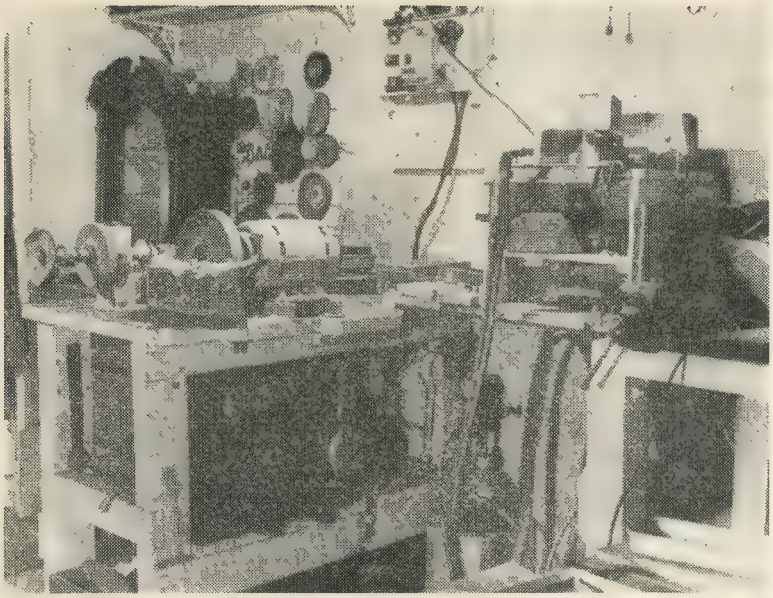
Only a motor rated for " maximum starting torque " should be set to do this kind of job.

Up to the present the air-inlet filter has been packed with fine steel wool (Brillo) lightly saturated with soluble cutting oil. This arrangement undoubtedly keeps out dust, but moisture is not entirely eliminated. The compressed air passes into a primary receiver which acts as a separator, and about a spoonful of liquid accumulates there in a month of normal use.

I do not use the plant for paint spraying and whatever moisture may accrue at the brazing torch causes no inconvenience. However, as a matter of curiosity, I propose to pack the filter with silica gel to test if it will eliminate moisture altogether.

The pressure control unit cuts out at 100 p.s.i. and the reducing valve on the storage bottle is adjustable to suit the work in hand. As the nearest gasworks is about ten miles away I have to be content with the much more expensive, but hotter, butane gas. Reduced air pressure with this fuel ranges between 12 and 20 p.s.i., depending on the work.

The diagrammatic arrangement of the plant looks a little expensive and complicated, but, in point of fact, almost all of it is home-made or the



The grinder and compressor bench

merchandise of the second-hand market. The air storage bottle, for instance, was RAF scrap, and cost me about five shillings, plus a few coppers to have a boss welded to the side for the air inlet.

The pressure control unit was rather more costly but I noticed what appeared to be a very sound design in a recent issue of MODEL ENGINEER. The air reducing-cum-safety-cum-stop valve unit is, I believe, an out-dated model from an oxygen gas bottle and my specimen was picked up in a garage for a few shillings.

The market in second-hand gas regulators appears to be spread a little thin and it is more than likely that maker's price may be called for here.

THE SWITCHBOARD

A single switchboard is used for controlling the machines on this bench and a diagrammatic arrangement of the wiring is reproduced. To avoid unnecessary complication earthing connections are omitted. The single knife switch cuts in whichever motor is required, while the two-way switch reverses only the grinder motor, this being a necessary feature to enable either wheel to turn towards the operator.

The Flamemaster torch, an excellent tool, is primarily for hand operation, but there are times when it is desirable to have both hands free, and on such occasions it is secured in a bracket which can be swivelled in vertical and horizontal planes.

The bench in the north-east corner is a veteran of several workshops and being now rather wobbly is used only for light work. The Diprofil motor is suspended from a free-swinging arm, which can be raised or lowered to suit whichever handpiece is in use. The motor and flexible shaft will also drive—I hope—one of Duplex's engraving machines when I get it completed.

Here, the tail end of the Littlejohn peeps into the picture once again. The only keys necessary for every-day purposes are shown in the usual "ready use" position on the front face of the bench.

The topmost shelf is not really a cocktail bar, although one or two of the bottles may have passed that way in the course of their descent to more prosaic levels. The contents include lubricating, cutting and tempering oils, rust preventatives, methylated spirit, petrol, turps, thinners, lacquers and other non-potable liquids.

The drill stands hold fractional, number and letter drills. As purchased they are not the easiest things in the world to take hold of, particularly with oily fingers; therefore, each has been fitted with a spindle screwed into the stand at its loaded centre of gravity. A small knob at the top of the spindle will simplify lifting to a large extent.

The headband serves a dual purpose: the twin lenses lend magnifying power to the ageing eyes, while the visor often protects the patriarchal brow against the spotlamp.

Finally, the question I am regularly asked: *What do you make?* In broad, categorical order of importance: ornamental work in ivory and hard woods (without becoming involved in ornament for the sake of ornament!); tools and accessories with which to make more tools and accessories; the odd steam-engine model; fishing rod fittings; maintenance service for two cars and a bicycle. ▣

Corner of the east and north walls

Steam car design

In this article the engine is discussed. GEORGE W. McARD favours the two-cylinder horizontal simple double-acting type

THOUGH I hope that the *entire* steam car project will be undertaken with enthusiasm by many readers, one feels that the engine and all the incidental mechanical accessories—pumps and so on—will hold a special interest for model engineers generally, notwithstanding the unusual difference in scales.

The engine has the charm of variety in the many alternatives available, and the first thing builders must do is to decide on the type of engine they consider most suitable for their individual purposes.

The relative merits of simple and compound working are well known today, and the Doble and White cars are top-grade units with the engine cylinder ratios most carefully proportioned, i.e. high and low pressure. Both these cars have achieved the desired end of economical consumption.

Few will deny, however, that a compound engine is inevitably complex in both design and manufacture, and many engineers question whether the saving in steam which accrues justifies the variation in cylinder sizes and operational details which necessarily follow. There is an attractive simplicity about the non-compound and simple engine that appeals to many engineers, among whom Serpollet and Stanley each produced excellent designs.

The type of engine—simple or double acting—and the number of cylinders to be included is another point to settle and this, of course, will be influenced by the power output to be obtained. Stanley Brothers used d.a. engines of 10 and 20 h.p. for their roadster models, as the open touring cars were then styled, and the White engines were usually of 18 or 30 h.p.

The Doble 4-cylinder compound d.a. engine developed around 120 h.p. on brake test under maximum output, and with so much power at the driver's disposal it is scarcely surprising to find this car so excellent a demonstrator of all the desirable features of a steam car. The addition of superheating equipment is one of the prime reasons for success, the ensuing steam-gas enhancing the output of the entire machine tremendously when compared with that of a saturated steam unit.

The engine I recommend is the two-cylinder horizontal simple double-acting type (Fig. 7). This is somewhat on the lines of the Stanley but is *not* geared to the rear axle as is the latter.

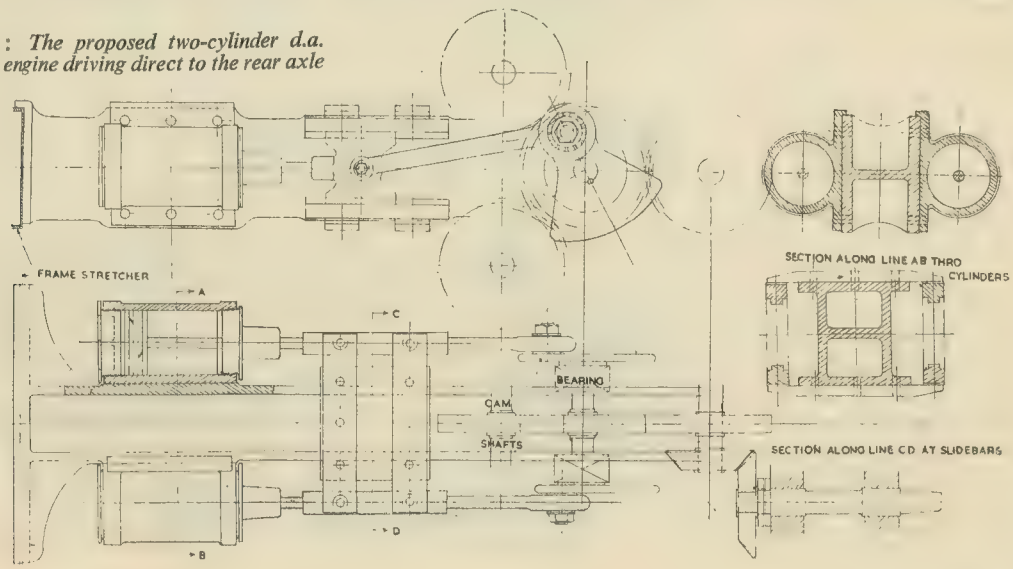
At this stage the method of transmitting the engine torque through to the rear axle calls for a decision, and the best scheme in my opinion is by cardan shaft direct from the engine, with the intervention of a single train of bevel gears, the gears being suitably proportioned to slightly increase outgoing torque.

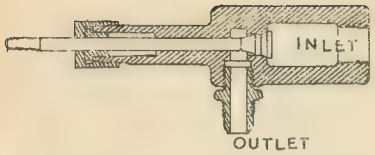
Reversing will be provided in the poppet valves, the movement of the cams being under electrical or mechanical control from the driver's seat. The engine would thus be placed on the centre line of the chassis, but if preferred it could be built as a V-type with an upper angle of around 120 deg. between cylinder centre lines. Although unusual, I see no serious disadvantage in this type, but rather a distinct benefit in the single-crank driving shaft, the connecting rods being articulated thereto. In such a case the engine would sit transversely across the chassis and drive directly to the rear axle without the necessity for bevel gears.

Whichever type of engine is decided upon either will give a big advantage over the Stanley and Doble machines in that the engine is completely springborne, thus reducing the deadweight coming on the tyres at the rear axle. Incidentally, the engine itself benefits through being isolated from all road shocks.

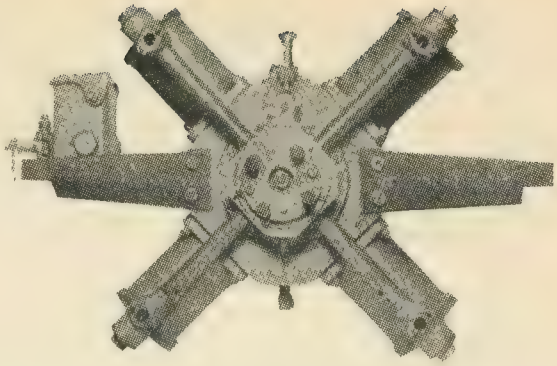
Single-acting engines may be extremely simple in design and operation, and the four-cylinder radial

Fig. 7: The proposed two-cylinder d.a. simple engine driving direct to the rear axle





Left, Fig. 9: Typical design of a steam throttle valve



Right, Fig. 8: Planet four-cylinder s.a. radial engine

engine (Fig. 8) has a special appeal to many engineers. The two-cylinder d.a. unit, however, will give equal, if not more, power in a much smaller compass, the cubic capacity necessary for a flat engine lying horizontally along the car being probably one half that required for the V-type, or the radial.

POWER OUTPUT

The formula used to determine the engine power output is the well-known: indicated horsepower = PLAN/33,000, where P = the mean effective steam pressure (p.s.i.) acting through the stroke, L = the stroke length in feet, A = the piston area in square inches, and N = the number of strokes per minute, i.e. twice the number of revs/minute for a d.a. unit.

A double-acting engine of the type suggested, with cylinders 3 in. dia. and stroke of 5 in., working at 300 r.p.m. under steam at an m.e.p. of 300 p.s.i., would deliver not less than 25 h.p. at the road wheels. Assuming your flash type generator to work at 600 p.s.i. you would then have a total reserve engine power of around 40-50 h.p. available for accelerating or hill-climbing emergencies, with easy steaming at the lower pressure for normal operation.

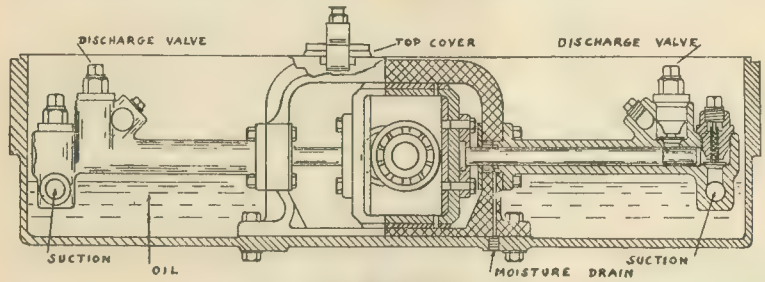
At this stage I would suggest a decision as to whether a clutch must be included in the transmission scheme, as this detail, though not essential to the drive of a steam car, can be a most useful asset at times, i.e. when testing the power set with the car static is but one of many such occasions.

VALVES AND OPERATING GEAR

As to which valves are to be used the poppet valve definitely leads in knowledgeable circles—its only rivals being the D-flat slide valve (so common in steam-engine operation in earlier days) and the piston valve. The flat valve was used by Stanley, but today it is unsuitable owing to the high degree of superheat in the steam delivered from a flash generator; the flat surfaces of this valve warp badly under high temperature and power is, therefore, lost through steam leakage.

Piston valves are preferred by some designers for compound engine operation, though even here I suspect the small diameter of the valve which may be used is against their successful operation.

Poppet valves, however, are simple, will stand high temperature steam, are easily ground in and can be designed to give just the valve events (cut-off, release, compression and reverse) desired. Valve gears like the Stephenson and Walschaerts, so commonly used with piston and D valves, have too many wearing faces, and sooner or later they develop the slack which is anathema to correct valve action. Separate camshafts should be provided for the control of poppets for steam and exhaust, with the valve boxes for the former above and for the latter below the cylinders. Throughout the entire engine design ball, roller or needle bearings should be used wherever possible; as they minimise the wear problem, are easy to maintain and lubricate, and absorb less power than plain bearings.



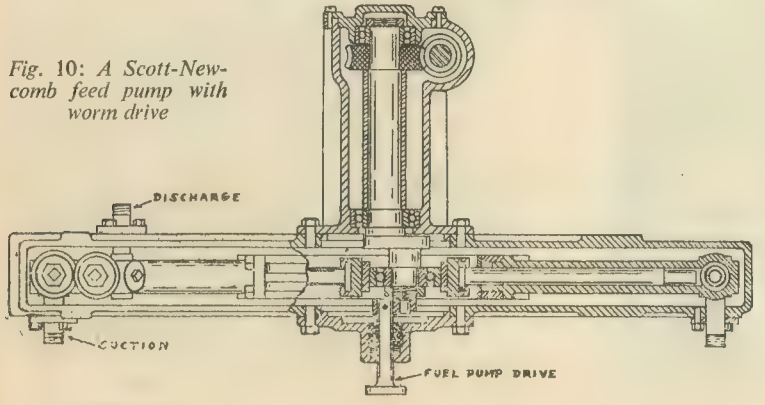


Fig. 10: A Scott-Newcomb feed pump with worm drive

THROTTLE VALVE

A detail which has an important bearing on successful motoring is the pedal-operated throttle valve, of which many types are in service. The design shown in Fig. 9 has given success over a long period, and in all such details the materials chosen are as important as the design and the quality of machining finish. The engine piston heads may be of aluminium, providing proper tolerances are given to compensate for the relatively large expansion which occurs with high-temperature steam.

UNIFLOW ENGINES

Before leaving the subject of valves and their operation, reference should

be made to the uniflow method of exhausting the steam. As the name indicates, the steam never reverses its direction of flow in its passage from inlet to outlet, and this has the obvious benefit of reducing condensation.

In the operation of the best design of uniflow engines, giving low steam consumptions of 10 lb. per i.h.p./hr, the cylinder heads are steam-jacketed to reduce condensation losses, and pistons are lengthened to ensure that the exhaust outlets provided in the cylinder perimeter are fully covered during that portion of the stroke when the expansive properties of the steam are given full play. For special research work in steam car service this type of engine would provide an excellent medium, but the ordinary steam-car designer is advised to develop his plan by using poppet valves.

FUEL SERVICE

From what has already been stated under the burner section it will be realised that an efficient system of fuel and water supply must be devised if steam is to be available for every demand. This may seem a tall order, but it is, in fact, a feasible proposition, and the success of the whole venture hinges on the ultimate outcome—though obviously alternative arrangements may have to be tried before the ideal is discovered.

Remember that this should not merely give the desired results, but must prove to be the simplest possible scheme, one which will be capable of operation by an unskilled driver.

Assuming right away that paraffin will be used with a spray type burner, the scheme must ensure that the flick of the switch on the facia panel will start the blower motor and, at the same time, close the circuits for the fuel-pump power line and the sparking plug.

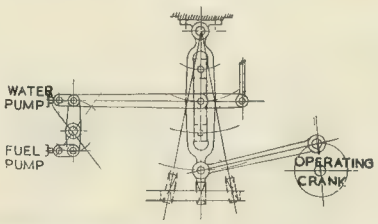
The air flow should be directed through swirler vanes to make certain that the fuel is perfectly mixed, and the spark should be very much hotter than that used in the average run of an i.c. motor. Some expert operators use an electrical transformer which gives a 10,000 v. spark from an original input of 12 v. d.c., converted by battery-driven converter to 115 v. a.c. fed to the transformer.

Unless the spark fires the charge instantly, unburnt gases pass into the combustion space and backfire later as flame once again circulates. The fuel should pass through a filter of adequate capacity, and deliver to the pump an ample supply of perfectly clean oil at all times; a time-fitting in the circuit will delay the initial operation of the fuel pump solenoid sufficiently to ensure a generous supply of fresh air to the combustion chamber; this will guarantee immediate ignition of the mixture when oil begins to flow.

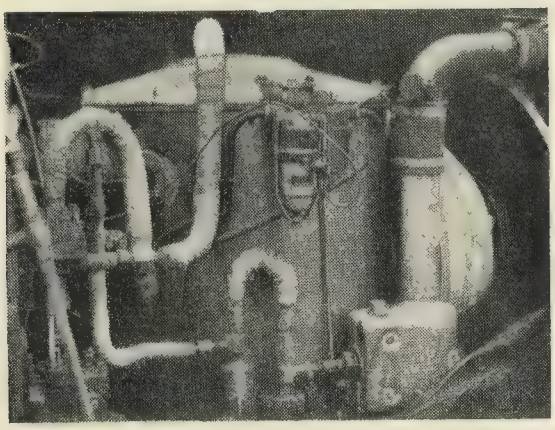
WATER FEED

This section offers great scope for ingenuity as the adequacy of the water supply to the generator and its subsequent effective control can make or mar an otherwise excellent machine. Direct acting (reciprocating) pumps should be used, of suitable capacity for any feed up to the maximum. Many types have been evolved, but the Scott-Newcomb feed pump (Fig. 10) is perhaps among the finest yet produced.

Valve lift is limited to 0.0625 in. to eliminate the objectionable noise so commonly experienced, and all working parts run submerged in oil. No stuffing boxes are required, and the pump rams, of considerable length and of hardened high chromium steel, usually possess a long working life.



Above, Fig. 11: *A slotted link type of pump drive*



Left, Fig. 12: *The turbine-driven condenser fan on a Doble steam car*

In my first article I referred to the necessity of proper control of the water content in a flash type generator, and various ideas have been developed to ensure this objective. In one design the fuel and water-pump rams were driven from a pivoted slotted link similar to that seen in Fig. 11.

The size of the rams and the strokes were proportioned to ensure that in any location the amount of fuel delivered to the burner would be correct for the volume of water supplied to the generator.

The designers of the Scott-Newcomb machine had the same end in view when driving their feed and fuel pumps by an electric motor common to both. In either scheme it is intended that steam of correct superheat temperature and pressure will be delivered in such volume as the work the engine is called upon to perform demands. Various devices are fitted in steam cars to attain this happy state and the careful designer will study as many of the existing systems as possible to avoid repeating any obvious or proved defects.

CONDENSER

To comply with legal demands it is compulsory for a condenser to be provided to deal with the exhaust steam. To pipe the exhaust to the radiator and the latter to the water supply tank would not be sufficient, as the back pressure created on the engine pistons by condenser resistance could seriously reduce the power output of your engine.

A well-designed power-driven fan behind the radiator will guarantee a good flow of air over the condenser tubes, and a vacuum pump located correctly on the pipeline will help the steam flow through the condenser and reduce the back pressure.

The power for driving the fan may be provided by a two-stage exhaust turbine (as fitted by Scott-Newcomb) or a pulley on an extension shaft driven from the engine or the auxiliary mounting; this latter, an excellent scheme, is found on the Doble car, and has much to commend it [see Fig. 8, p. 24, MODEL ENGINEER for 3 January 1957]. In some of the later Doble cars a turbine-driven condenser fan is provided; this enables more economical use to be made of the exhaust steam as it passes to the condenser, and eases the work on the latter (Fig. 12).

● *To be continued*

SIMPLE PATTERNMAKING

By Geometer

ABILITY to produce simple patterns in wood from which castings can be obtained frees a constructor from continued acceptance of commercial designs —and the limitations and work involved in built-up or fabricated constructions.

It need not be overlooked, of course, that early efforts may not be so good as comparable commercial designs, not that a particular component might not have been equally well made by a skilled operator of welding equipment. But granted these, it then remains virtually indisputable that castings do, as a rule, provide the best means of construction, with freedom—when of one's own design —to express ideas mechanically.

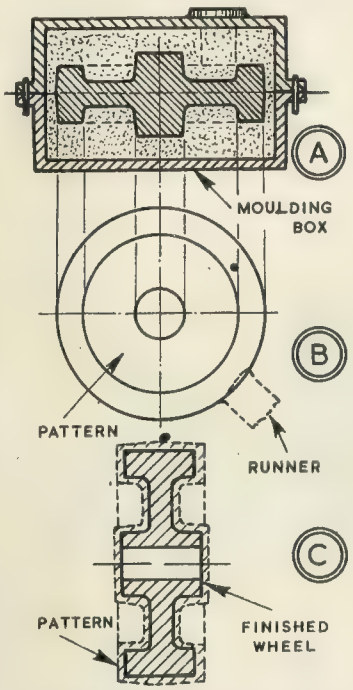
Woods employed for small patterns should be the hard, close-grained variety—boxwood, beech, oak, ash—that can be turned in a lathe reasonably easily without tearing. Rotational speed should be as high as possible, and tools should possess ample rake and clearance. Complicated shapes can be built up by gluing, screwing, tacking and dowelling pieces of wood together, interstices being filled and fillets formed with plastic wood or putty, the surfaces finally smoothed with sandpaper and painted with a filler paint—followed by further rubbing down and painting if required.

An important feature of any simple pattern (which resembles the casting to be produced) is that it must leave the mould cleanly, and to ensure this fact is not overlooked, it is necessary to keep in mind the principle on which such a pattern is moulded. At *A* and *B* is shown in section and plan the pattern for a flywheel, which could be cast in cast iron. The moulding box at *A* is in halves, dowelled together.

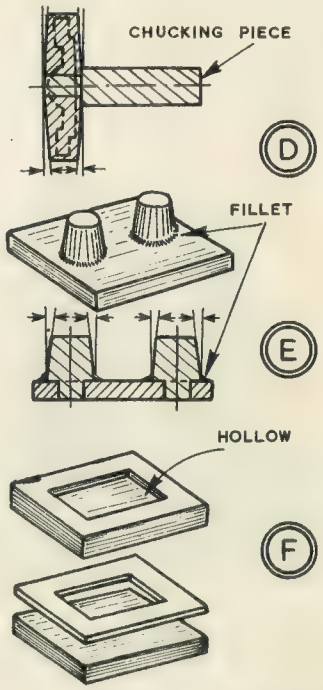
The pattern is pressed into the sand in the lower half to form its shape, while positioning the upper half of the box causes the shape to be similarly formed in the sand of the upper half. Taking off the upper half of the box, removing the pattern and replacing the upper half, then provides the mould into which the metal can be poured through a channel.

As the pattern is relieved to form a central web on the flywheel, the pattern must be positioned horizontally as shown, for if the pattern were placed vertically the sand close to the web would inevitably be disturbed on lifting it out. A simple pattern, therefore, must in at least one attitude be free of "undercuts."

Where machining on a casting will be necessary, an allowance must be made on the pattern, and where a casting will be of substantial size and not necessarily machined all over an allowance must be made for metal shrinkage. Per foot of length, this allowance is 1/10 in. to $\frac{1}{8}$ in. for cast iron; $\frac{1}{8}$ in. to $\frac{3}{16}$ in. for aluminium and 1/5 in. to $\frac{1}{4}$ in. for brass. If desired "contraction" rules can be used on which all dimensions are these proportions overlength.



On small patterns the machining allowance will easily accommodate shrinkage on the castings. For general purposes, an allowance of $\frac{1}{16}$ in. is satisfactory. If one is sure of good small castings reduction to 1/32 in. is possible; where there is doubt an increase to, say, $\frac{1}{8}$ in. is advisable. The allowance must be added to all surfaces as at *C*. On wheels, where the "runner" in the mould is to the periphery, extra allowance counteracts a possible adjacent hollow.



A simple pattern for casting a circular cover, as at *D*, may be provided with a shank as a chucking piece. Machining the casting the shaped end of the cover and outside would be turned holding the chucking piece; this would then be sawn off, and the cover held by the outside for finishing the step and end.

Features of any depth to draw from a mould should be tapered on each face about two deg. as shown. Bosses, as at *E*, may be dowelled and glued in, and fillets made with plastic wood, while a pattern with a hollow can be built up from two pieces glued, as at *F*. ▣

POWER for model boats

In the second article of this series which deals with model power boat propulsion EDGAR T. WESTBURY considers electric motors

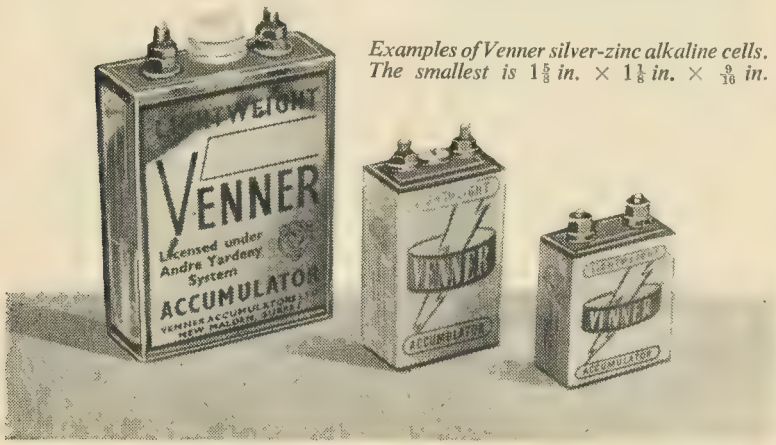
Continued from 31 October 1957, pages 618 to 620

THE constructor of a prototype boat who wishes to furnish it with motive power in the simplest possible way usually chooses an electric motor for this purpose, particularly if the boat has had a good deal of care devoted to its external appearance and detail work. There is a natural reluctance to install a form of power plant which may be likely to impose heavy mechanical strain on the hull structure, or involve the risk of damage by fire, or even scorching of paintwork by the proximity of heated pipes.

Electric motors, being free of these objections, may be employed in the most delicate or highly-finished hulls, and further advantages are that they are easy to install, always ready for instant use, readily controllable and clean in use. For any type of craft which is not required to attain a high performance, they constitute the most convenient source of power possible, and the ease with which they can be started, stopped, regulated or reversed makes them particularly well adapted to radio control.

Against this, however, may be set the disadvantages that most normal electric installations employed in model boats are relatively inefficient, have a low power-weight ratio, and where expendable batteries are employed, expensive to run in relation to power output.

Compared with steam or i.c. engines, the actual power produced by electric motors as employed in model boats is nearly always very low; and though it is now possible to obtain motors and batteries of very high efficiency, both their initial cost and that of upkeep are abnormally high. In general competition work, few electrically-propelled boats have shown up really well, and they are very much in the minority as compared to steam and i.c., at open pond events.



Examples of Venner silver-zinc alkaline cells. The smallest is $1\frac{5}{8}$ *in.* $\times$ $1\frac{1}{8}$ *in.* $\times$ $\frac{9}{16}$ *in.*

Of all forms of motive power, electric motors give the least scope for making the engine room look anything like the real thing, and very rarely is any attempt made to do so. It is true that commercially-made motors have been made to work externally like marine steam or diesel engines, but this is mere camouflage; and though there are full-size ships with electric propulsion, they carry their own generating plant as well, and this is hardly comparable with the installation as used in models, if one seeks for realism.

However, it cannot be denied that electric motors have a high utility rating in this sphere, especially for the smaller boats, where a simple and inexpensive plant will satisfy all the power requirements. As an introduction to model power boats, they offer many attractions, but my experience is that their limitations, and perhaps even more their monotony, are soon apparent and cause them to lose favour among serious constructors.

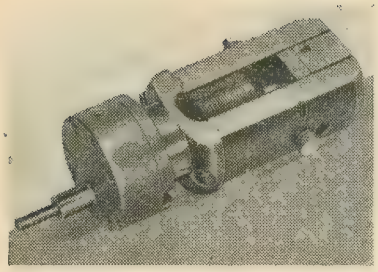
POWER OUTPUT

In describing electrically-driven boats as relatively inefficient, I shall probably lay myself open to attacks by some of the zealous "electrophiles," who will assert that they have boats which run at ten knots on tiny motors powered by a couple of Penlite dry cells. I do not wish to indulge in an argument on this subject (though it is significant that the speeds quoted are rarely supported by the evidence of a stop watch over a measured distance!) but I will simply quote facts about electric power, and leave readers to their own conclusions.

As I have already stated, one cannot assess how much power is required to drive a particular boat at a given speed, as many complicated factors are involved, but it is possible to make comparisons between the different forms of motive power in respect of potential, if not actual, performance.

I find that despite the advantages of modern education, many people have some very hazy and often erroneous notions about electricity and, in particular, of what a limited supply of it is capable of performing. Believe

The Exide three-cell (6 *v.*) *lead-acid accumulator* (*type* 3-*MBI*). *It weighs* 3 *lb.* 9 *oz. and measures* $4\frac{1}{16}$ *in.* $\times$ $2\frac{11}{16}$ *in.* $\times$ $3\frac{1}{2}$ *in.*



The high-efficiency permanent magnet motor, with integral 2 to 1 reduction gear, which is marketed by Bond's o' Euston Road

it or not, but I often have to deal with queries from optimists who propose to propel a bicycle with the aid of a dry battery or a photo-electric cell, using a transformer or amplifier to "boost up" the power! Many of them appear to acquire these brilliant ideas from popular digests and "armchair science" books, in which pretty little analogies are used to save them from the stodgy business of learning Ohm's law.

Electricity as applied to most practical purposes, including mechanical power, consists of two factors—volts (potential or pressure) and amperes (current or quantity), the product of which is watts, representing the actual power content. Theoretically, 746 watts will produce one horsepower, but owing to inevitable conversion losses, as high as 33 per cent or more in small motors, a practical estimate may be at least 1,000 watts per horsepower.

How much power, therefore, can we expect to obtain in the average model power boat electrical installation?

Taking the smallest and simplest motors first, many of these are powered by dry batteries of popular types; a typical example seen running on the pond recently used a cycle lamp battery of two cells, producing 1.5 v. per cell. Such batteries cannot be discharged at much more than one ampere, so that the available power is about three watts, or 0.003 h.p.

A much larger boat observed at the same time had a converted war surplus motor, powered by an accumulator of 6 v. 20 ampere-hours capacity. The safe discharge rate of this would probably be about two amperes, so that 12 watts, or 0.012 h.p. would be available.

These figures, however, are by no means as bad as they look, because a very small amount of power will suffice to drive a boat at speeds up to one or two miles per hour, but the resistance rises at an alarming rate (readers who object to my lack of precision in terms should look up Froude's Law, in any textbook of hydrodynamics) as speeds are increased, and thus the difficulty of obtaining high performance, or the ability to battle against wind and tide, when this form of motive power is used, will be apparent.

BATTERIES

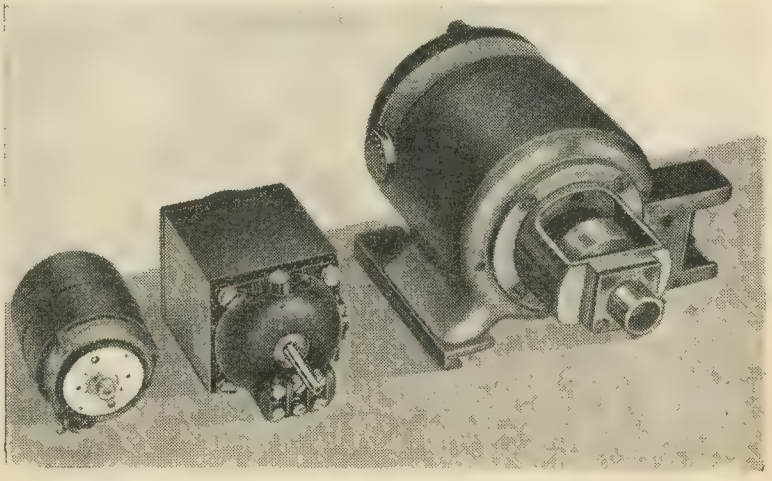
The only really practicable source of electric supply for a model boat is something which can be carried on board, and unless one is prepared to install a generating plant (an interesting line of research for the experimenter, but difficult to exploit to ultimate practical advantage), the only alternative is a battery. I have, it is true, seen a boat fed with current through a power line from a generator on the bank, but this is obviously inapplicable to free-running craft.

Batteries are of two types, namely, "primary" and "secondary," both of which derive their power from chemical action; but in the first type, which includes dry batteries, this action involves a degeneration of the battery elements, and is not recoverable in the normal course of events, while in the second type, or accumulator, the action can be reversed, and the battery is thus capable of being recharged. I know a lot of readers will now fall over themselves to tell me that they can recharge dry batteries; but this is only possible to a limited extent, for various reasons.

As to the comparative merits of the two types, much will depend on the conditions under which they are used. Dry batteries are generally limited to a relatively low current output, except for very short intermittent periods, and if too rapidly discharged the voltage will decrease almost to vanishing point, though it will recuperate to some extent when out of use. The normal voltage of a dry cell is 1.5 v., and no single cell, however large, will produce any higher voltage, though the current capacity will increase in proportion to the size, or properly speaking, the area, of the active elements. In any form of primary battery, the "fuel" is the negative plate, or anode, usually zinc, which is chemically consumed in the course of discharge.

Secondary batteries are, generally speaking, capable of much higher discharge rates than the primary type, and can be made with a large plate area for purposes where this property is highly important. When in proper working order, the voltage is practically constant until the batteries are almost completely discharged, so long as the rated current output is not exceeded. The standard lead-acid accumulator delivers two volts per cell, and is usually designed to be capable of continuous discharge at a rate of one-tenth of its total capacity; thus a 30-ampere-hour battery will deliver three amperes for a period of 10 hours.

Alkaline batteries produce about 1.2 v. per cell, and are capable of high rates of intermittent discharge with less risk of damage to the plates than the former type; they can also be charged very rapidly, and are generally more durable. The best-known type of alkaline accumulator in this country is the Nife nickel-cadmium type, but in recent years the Venner silver-zinc type, which can be made to produce a very high current capacity for the minimum bulk and weight, has become very popular among constructors of high-efficiency radio controlled boats.

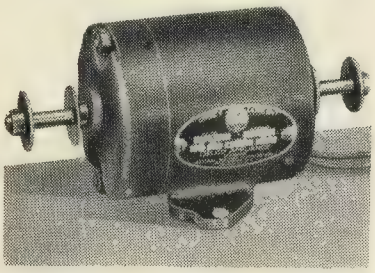


Three sizes of ex-service motors by Scottish Distributors Ltd

These batteries tend to be very expensive in initial cost but, being rechargeable, the ultimate cost of the electrical energy produced may work out much less than for dry batteries. In one case, a battery of 20 miniature silver-zinc cells in a model boat is stated to produce nearly 400 watts output, which is abnormal for an electric installation, being equivalent to over 1/3 h.p.

MOTORS AVAILABLE

There is a very wide choice of electric motors available, either made specially for driving models or for other purposes, but capable of being adapted. The cheap, popular types are, generally speaking, only suitable for propelling the smallest and lightest model boats, though it is, of course, practicable to install more than one in a hull, to drive either separate propellers, or geared together so as to drive a single propeller shaft.



A 27 v. 1.5 a. shunt-wound motor (ex-service) by K. Whiston

While these motors generally run reliably and produce a reasonable power for their size, many of them suffer from two serious practical defects: lack of adequate bearing surfaces, and flimsy or badly designed brush gear and commutators. Some of them run very roughly and noisily, and this is always a symptom of inefficiency. These objections do not apply to the more robust motors designed specially for model boat work, or adaptable types intended to cope with continuous hard work, such as those made for motor car windscreen wipers or heater fans.

One of the best-known marine electric motors is the Bassett-Lowke Permag type, which is made in two sizes, the smaller being suitable for boats from 18 to 24 in. long, and the larger for 3 ft boats. Bonds o' Euston Road produce a powerful motor, not specially designed for boat work, but readily adaptable to the purpose; this can be obtained either with direct drive or with a gearbox incorporated, to give a reduction of 2 to 1 ratio. Two of these motors would make a suitable power unit for a large model such as *St Ninian*.

I do not propose to make any statements about the power of these motors, because in my experience the limiting factor in nearly all cases is not the motor itself but the current available from the battery; and the performance of the boat itself—which is what really matters—is in turn limited by the battery power which can be carried within the weight-carrying capacity of the hull.

WAR SURPLUS MOTORS

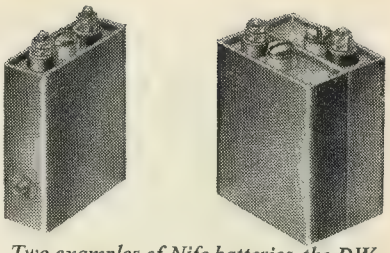
Many types of small motors are now available on the surplus market at attractive prices; they are of high class design and manufacture, having been made for the auxiliary equipment and instruments of aircraft or weapons of war, where absolute reliability is essential. Some of them are very powerful for their size, and will produce quite a good performance on voltages lower than that for which they are designed. They may call for some adaptation to make them suitable for model boat work, but they are well worth it.

Motors of this type are generally rated at 12 to 24 v., which is higher than is usually contemplated for use in boats, but this is not necessarily a disadvantage if one is prepared to install batteries of the required number of cells to produce the voltage. Other things being equal, a given number of watts will produce the same power, whether it consists of a high current at low voltage or a low current at high voltage; but in practice the latter is usually more efficient, because the percentage of power lost in resistance and brush friction is lower. The increase in the number of cells may be counterbalanced by a reduction in their size, as the current capacity can be proportionately lower.

If, however, a large number of cells is inconvenient, or too expensive in initial cost, it is possible to rewind motors to run on lower voltage, though few model engineers are prepared to undertake this work. The construction of electric motors has also declined in popularity, though it is quite an interesting job, and plenty of practical information on the subject is available in the ME handbooks *Small Electric Motor Construction* and *Practical Armature Winding*.

MOTOR CHARACTERISTICS

Most small motors are series-wound, in other words, the field and armature windings form one continuous circuit. Such motors have a high starting torque, and run fast on light load but tend to slow down as more load is applied. Some of the surplus motors are shunt-wound, the two windings each being in complete parallel-connected circuits; they have a lower starting torque, and will not start a heavy load from rest, but once up to speed, they resist changes in speed with varying load. They will not run on alternating current, but that is of no concern where batteries are the only source of supply. It is possible to convert motors from shunt to series winding (or vice versa) by changing over connections; this will alter the voltage rating in proportion to the change in resistance thus brought about. A series motor, altered to shunt connection, will thus run on about half its former voltage, and consume twice as much current; but conversions are not always completely successful, as much depends on details of design.



Two examples of Nife batteries, the DW 13 single-cell and twin-cell all-metal units

Permanent magnet motors do not need field windings and, as it is obvious that energising a wound field must call for some expenditure of current, one would expect the use of a permanent magnet field would improve efficiency, in terms of current consumption, but this is not invariably the case; design affects the matter in this case also, and furthermore these motors will not run on a.c. either.

Motor speed may be controlled most conveniently by means of a variable resistance in the circuit, but as the resistance wastes current, it is not the most efficient method; the alternative, only possible when a large number of cells in series is employed, is by cutting out cells selectively, or by parallel-series switching.

The great majority of small motors develop their best efficiency at fairly high armature speed, and it is desirable to adjust the load so that this speed is maintained under running conditions. Many small boats have grossly overloaded motors, which are slowed down far too much by the propeller; the remedy is either to reduce the size and pitch of the latter, or to drive it through reduction gearing. The pros and cons of these alternative methods, which apply also to other forms of motive power, will be discussed later.

● *To be continued*

BOOK REVIEWS

DOWN TO EARTH FACTS ON SPACE

SATELLITES AND SPACEFLIGHT

By Eric Burgess (Chapman and Hall, 21s.). 159 pages. Illustrations, graphs and tables, index.

THE establishment of any kind of satellite vehicle is a most important instant in human history, says Mr Burgess. The dramatic events of recent weeks, when the whole world hung on the news of the progress of the Soviet Sputniks, circling the earth every hour or so, proved at any rate that the world did not underestimate the importance of that instant.

Eric Burgess' book is a factual survey of developments in the field of rocket propulsion, interplanetary travel and the establishment of satellite bodies. The writer is a distinguished expert, a founder member of the British Interplanetary Society and the author of several books on allied subjects.

It isn't often that we get such an opportunity as this to check the facts against the theories. But it must be stressed that it is a measure not of the author's shortcomings but of the rapidity of developments in this field that some of the facts are out of date before the book is published.

For instance, he says that the take-off weight of a rocket, calculated to put a satellite in an orbit such as the Sputnik I's, would be about 80 tons. There are already claims that the Russians have developed a new fuelling agent that would greatly reduce that weight.

This book does not depend on Wellsian interpretations or science fantasy; it is firmly based on the facts. One such fact is recorded without comment—that the tremendous sums spent on developing new armaments has made the major contribution to our knowledge of the conditions necessary for space flight. It is a fact which carries its own irony.—E.W.

SIXTEEN ON

Edited by Charles Irving (London: Macmillan and Co. Ltd). 240 pages, 5 in. x 7½ in. Price 16s.

MANY readers enjoy railway fiction as a change from the more technical literature; it helps to while away an hour or two in a more or less familiar atmosphere. Here is just the book to meet that need.

It is an "anthology" of 16 short stories by various authors, and they all depend upon the railway interest, as distinct from merely railway atmosphere.

The first is a welcome reprint of that most unusual of ghost stories, *The Signalman*, by Charles Dickens, weird and dramatic, without an equal in this class of literature.

The other stories provide gravity, gaiety and excitement in plenty, and prove that the editor has been most successful in his selection of them. His main problem, obviously, was what to omit. I feel that this collection must surely create a demand for more; technical knowledge of railways is not essential for the enjoyment of stories like these.—J.N.M.

THE CROMFORD AND HIGH PEAK RAILWAY

By A. Rimmer (Oakwood Press, Lingfield, Surrey). 36 pages, 4¾ in. x 7¼ in., illustrated by half-tones. Price 5s. 6d.

IN these days of nationalisation, with its predilection for closing picturesque and leisurely branch lines, it is heartening to hear of a small railway that has escaped the bureaucrats' axe.

This is the Cromford and High Peak Railway, which winds tortuously through the wild moors and limestone crags of Northern Derbyshire, serving, for freight purposes only, the quarries and townships of the area.

The history, development and working of this line, originally measuring 33 miles, is carefully described by Mr Rimmer following a visit to the system.

Of interest to the steam enthusiast are the unusual engines—locomotives and stationary—which have been associated with this railway, and though reliable information of the early motive power which displaced horse haulage is hard to come by, the author gives considerable detail of some of the old engines.

Among the illustrations are two fascinating pictures of these primitive engines—an ancient 2-2-0 with vertical, exposed firebox and no cab (they were stoics in those days), and an LNWR 2-4-0 tank which bears a strong resemblance to a recumbent walrus.

The CHPR can lay one claim to fame. It has the steepest incline operated by adhesion locomotives in the British Isles—1 in 14 ! Ex-North London Railway 0-6-0 tanks worked the line until recently, when they were replaced by former War Department 0-6-0 saddle tanks, class J94.

Those sections of the track which rise steeper than 1 in 14 are worked by cable, power being supplied by stationary engines. One of these, at the Middleton Incline, is reputed to be about 130 years old—the sole survivor of eight.

This is a well presented little book, packed with technicalities, and produced to the high standard one expects from Oakwood Press.—H.B.

THE DEVELOPMENT OF THE TROLLEY BUS

By Harold Brearley (Published by the Oakwood Press, Surrey). 36 pages, 5 in. x 7½ in. Illustrated by half-tones.

CAN there be a vehicle which has suffered more from the aberrations and vicissitudes of the designer than the trolley bus ?

In their short mayfly existence—for they seem to have germinated, pupated and almost passed away in the space of a cosmic day—they have provided more varieties than the famous manufacturers of baked beans.

The father of all trolley buses was built in Berlin in 1882 by Warner von Siemens, and was a cross between a milk float and a farmcart. Also made in Germany was a 151-seater articulated vehicle, and then there was the monstrosity built for Leeds City Tramways in 1921 which resembled a portable double-deck greenhouse with mineral attachments !

Harold Brearley, who was for many years in the mechanical department of Bradford Corporation's trolley bus fleet, has produced a handy little volume describing the history and development of this unique form of passenger transport.

The enthusiast will find it a concondensed library of information, illustrated with many historic photographs. It is printed on good quality paper and is the kind of pocket edition that can be happily thumbed through for years.—L.B.H.

Number 46

by J. N. Maskelyne

I SUPPOSE that locomotive enthusiasts all over the world must have known, or at least heard of, the famous GNR large-boilered Atlantics.

The design was by Mr H. A. Ivatt, and the first example, No 251, was put into traffic in January 1903; she was a true Atlantic in that she combined the 4-4-2 wheel arrangement with outside cylinders and a boiler with a wide firebox.

There is reason to believe that Ivatt, when designing his small-boilered 990 class, had in mind the large-boilered version because, as I mentioned in Article 22, the frames of the later 990s were so designed that a larger boiler could be fitted. However, that may be, the change was never made on those engines, and the apparent hesitation may possibly have been due to the fact that for some years the 990s would persist in showing themselves to be the better engines! Yet, construction of the larger-boilered engines continued, and the class eventually numbered 93.

It was at about this time that Ivatt made his well-known statement that the power of a locomotive depended upon its ability to boil water.

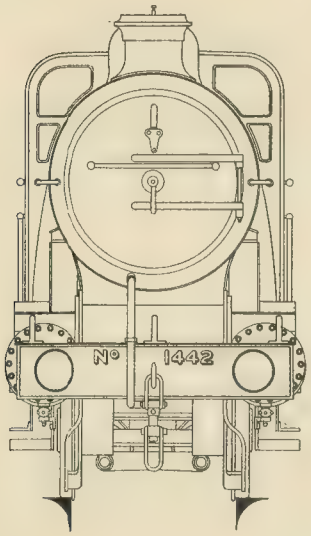
This is probably one of the most unfortunate statements ever made by an eminent locomotive engineer. I am not denying its accuracy, but it is unfortunate in so far that it has been misinterpreted by professional and amateur locomotive men ever since. It does *not* mean that the boiler should be the largest that can possibly be accommodated within the limits of the loading gauge!

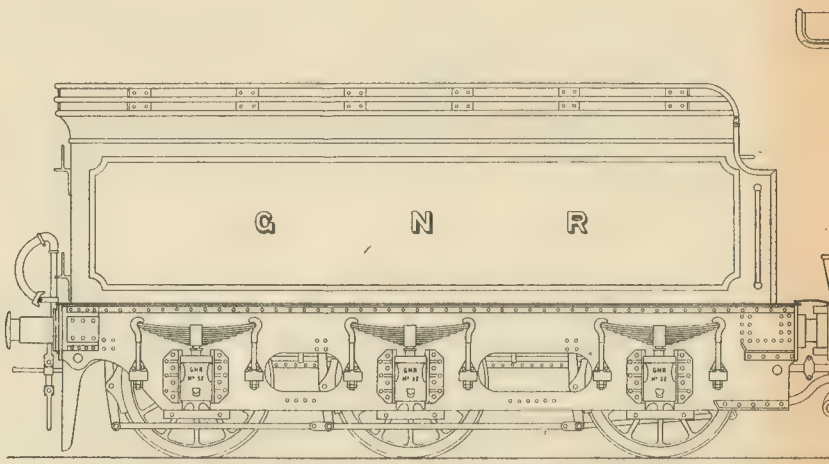
If any proof of my statement is needed it can be found in the locomotives that Ivatt himself designed for the Great Northern Railway; only on his large Atlantics did he provide anything remotely approaching an outsize in boilers, yet *none* of his boilers failed to produce the required amount of steam at any time. In size, they were perfectly normal, but their *proportions* were always adequate.

In the first few months of 1903 No 251 was kept under constant observation and was subjected to a certain amount of experiment, the smokebox arrangements coming under special surveillance.

At one period during her "probation" she was fitted temporarily with a stovepipe chimney, which did not enhance her appearance, but in due course, everything was put right, and between 1904 and 1908 a further eighty engines of the class were built. They took over the working of all the best and heaviest expresses on the old Great Northern and became firm favourites with the drivers and public alike.

I remember seeing No 1442 when she was on show at the Imperial International Exhibition, White City, London, in 1909. She stood side by side with the old Stirling 8-ft single-wheeler No 1, and a most interesting pair they made, typifying, between them, nearly thirty years of GNR locomotive development.





The GNR large-

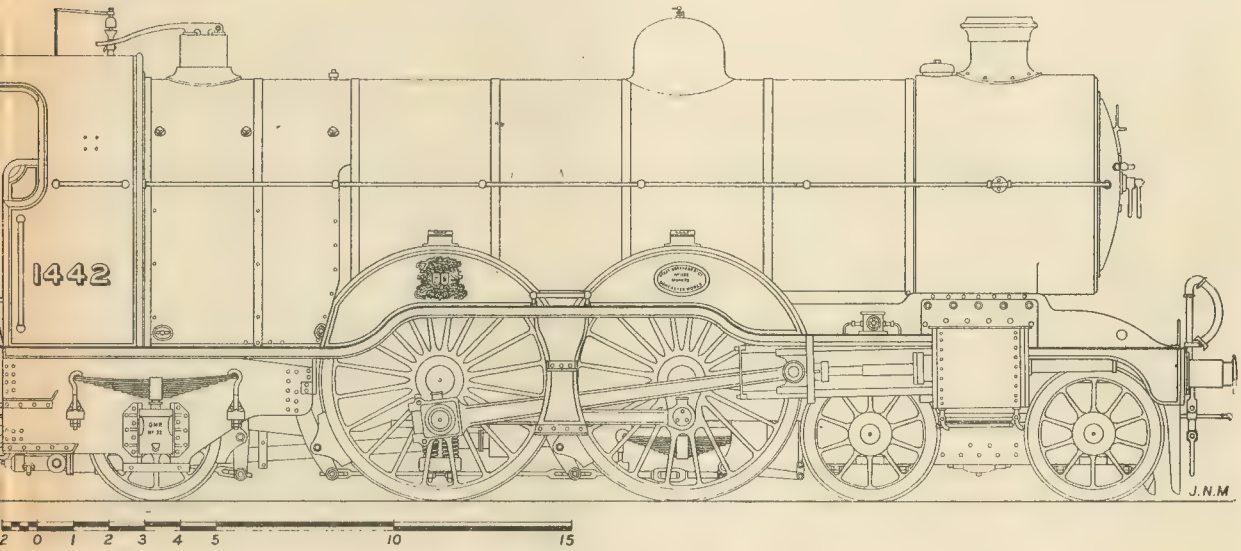
No 1442 was then one of the latest of her class and had done very little work before being sent to the exhibition. For years afterwards she was looked upon as being something rather special and was distinguished from all other GNR locomotives by having the company's coat of arms on her driving splashers. She was also always used for working Royal trains on the GNR and had tyres and axle-ends polished.

Up to that time Ivatt had not adopted superheating; he was not against it, but he was not convinced that the lubrication troubles that

accompanied it had been overcome.

However, in 1910, he relented and ordered ten new Atlantics, Nos 1452 to 1461, generally similar to their forerunners but fitted with Schmidt superheaters, following tests with that apparatus on No 998, one of the small-boilered Atlantics.

I am fairly certain that it was Ivatt's chief assistant, Nigel Gresley, who was primarily responsible for the decision to superheat these engines; at any rate in 1911, when Gresley succeeded Ivatt as chief mechanical engineer, he began to introduce some



boilered Atlantics

important detail improvements, which had the effect of placing all these engines among the very best in the world.

Some of their performances with such trains as the Yorkshire Pullman and the Queen of Scots—even the Silver Jubilee on one occasion—must rank for ever among the very finest exploits ever recorded with steam locomotives. Be it noted, too, that these extraordinary performances were achieved during the last years of these engines.

These statements of mine may seem exaggerated, but I claim that they are fully vindicated by just one almost incredible and duly authenticated effort by Atlantic No 4404 one day in 1936 on the down afternoon Scotsman. She was on pilot duties at Grantham on that particular day, when the Scotsman, comprising 17 very crowded coaches and weighing at least 585 tons, arrived. It was headed by a Pacific which was suffering badly from a hot bearing and had to come off the train.

No 4404 was substituted, and after an uncanny and almost superhuman effort at persuasion on the part of Driver Walker, of Wakefield, that huge train was got under way. Then, believe it or not, she ran the 82¾ miles to York, in 87½ minutes—2½ minutes *less* than the scheduled 90 minutes—and during the run covered a distance of 60 miles at an *average* speed of 64 m.p.h.

This effort was all the more remarkable because the engine was in a run-down condition and by no means ready for such a venture, but the performance is typical of the spirit of these redoubtable engines and their equally redoubtable drivers.

I have been told that one of the signalmen at Selby was so astonished at the sight of 4404 and those 17 coaches passing his box, that he rang up Grantham locomotive dept saying: "She passed here two minutes before we expected her, and is going well." I think that speaks for itself.

My drawing shows 1442 in the altered condition, typical of the class after 1911. In this form the dimensions were: Bogie and trailing wheels diameter 3 ft 8 in.; driving and coupled wheels diameter, according to the official drawings and specification, 6 ft 8 in. dia.

This dimension may be nominal because the distance between the driving and coupled centre lines is given on the drawings as 6 ft 10 in., which would not leave enough room for the normal 1¼ in. depth of the flanges. I think the wheel diameter is more likely to have been 6 ft 7⅞ in. and the flange depth 1⅛ in., or perhaps 1$\frac{3}{16}$ in., similar to the 990 class engines otherwise the flanges would have touched each other.

The wheelbase was 26 ft 4¼ in. divided into 6 ft 3 in. plus 5 ft 3¼ in. plus 6 ft 10 in. plus 8 ft.

The boiler was made in two rings, the back one of which was 5 ft 6 in. dia. inside. The length of the barrel was 15 ft 6⅜ in. and the pitch was 8 ft 8¾ in. above rail level. Outside, the firebox casing was 5 ft 11 in. long and 6 ft 9 in. wide, while its depth at the front was 5 ft ½ in. The grate area was 31 sq. ft.

There were 161 tubes of 2¼ in. dia. and 24 superheater flues of 5¼ in. dia., their respective heating surfaces being 1,884 and 570 sq. ft, while the firebox added 143 sq. ft to make a total of 2,597 sq. ft. The working pressure was 170 p.s.i.

In working order the engine weighed 69 tons 8 cwt, the bogie carrying 18 tons 12 cwt, the four coupled wheels 36 tons equally distributed and the trailing wheels 14 tons 16 cwt.

The pioneer engine of this outstanding class, No 251, is preserved at York, along with No 990, *Henry Oakley*, the first of the small-boilered Atlantics; they make a very attractive pair. ▣

ROSE

Continued from 24 October 1957, pages 580 to 582

This week LBSC concludes the description of the cab for the beginners' simple locomotive and goes on with instructions for building an alternative coal-fired boiler

THE difficulty about fitting a one-piece cab front to any locomotive with a boiler-barrel larger in diameter than the width of the firebox is that it cannot be erected without taking off the steam turret and any other fitting which may project.

To avoid this the cab front may either be divided vertically above the boiler or at the sides on a level with the widest part of the boiler barrel. The latter is the easier for *Rose*, as the cab front only extends down to the level of the trailing splashers, and only a couple of simple make-up pieces are required.

The upper part of the cab front can be cut from the same kind of material used for the cab sides, to the dimensions shown above the joint line in my drawing. The width should be about $\frac{1}{16}$ in. less than the overall width of the trailing splashers, so that the edges of these stand out just sufficiently to simulate the brass beading on the full-size GER locomotives of this type.

Mark off and drill the holes for the cab windows slightly undersize and finish with a reamer or they won't be truly circular. They can be " glazed " if desired by riveting a ring $\frac{1}{8}$ in. wide over each on the inside of the cab and putting a piece of mica or Perspex between cab and ring. Domestic pins snipped to required length make excellent rivets for jobs like this.

Rivet a piece of $\frac{1}{4}$ in. $\times$ $\frac{1}{16}$ in. angle down the full length of the front edge of the cab side and along the straight part of the bottom. Along the upper edge rivet a piece of angle bent from a strip of metal $\frac{1}{2}$ in. wide to the angle shown; you can do that in the bench vice. The upper part of the angle should be flush with the curve of the cab front. Next fit the cab sides to the front, with the corners flush and at right angles, and rivet the angles to the front. I do jobs like this by clamping temporarily the side to the front with a toolmaker's small cramp at top and bottom.

After adjusting drill the two centre holes and rivet with $\frac{1}{16}$ in. rivets, countersinking the holes (No 51 drill) on the front and riveting flush. Then remove the cramps, drill and countersink the top and bottom holes, and rivet up.

The cab front, with the two sides attached, can then be put in position on the engine, the back edge of the side sheets being $\frac{5}{16}$ in. from the back edge of the running board. Attach by a couple of 9 BA screws at each side, as shown in the small detail sketch.

Next fit the two make-up pieces between the lower edges of the cab front and the splasher and side of firebox. Cut a piece of thin card or stiff paper first, and fit it in the opening. Then cut a piece of metal to the same size and attach it to the angle on the cab side by two 9 BA countersunk screws as shown. If the joint is made close it will be practically invisible when painted.

The beading or edging around the curved part of the cab sides can be made from a strip of nickel bronze; even tin would do, $\frac{1}{8}$ in. wide, soldered on. Leave the back end projecting about $\frac{3}{16}$ in. and between this and the running board fit the pillar shown in the general arrangement darwing. This is just a piece of 15-gauge spoke wire with a little washer at the top and bottom. The lower end can go through a No 48 hole drilled in the running board, the upper end being soldered to the projecting piece of beading, which is rounded off to the diameter of the washer. Plated cycle spokes of various gauges can be got at any cycle shop, and these make excellent hand-rails and pillars.

ENGINE BUFFERS

The cab roof is made from a piece of brass, or tinplate, about 22-gauge, cut to the dimensions shown and bent to the same radius as the top of the cab front. Solder on the pieces of half-round wire as shown, then attach the roof to the angles on the cab sides by 9 BA screws as shown. An additional piece of $\frac{1}{4}$ in. $\times$ $\frac{1}{16}$ in. angle can be added at the top of the cab front for additional strength if desired.

There is no need to fit a detachable roof, as the handles on the footplate are easily accessible with the roof in position.

The buffer sockets can be turned from $\frac{5}{8}$ in. round rod, brass or steel. Chuck, face, centre, drill to 1 in. depth with a No 40 drill, open out to $\frac{1}{2}$ in. depth with a $\frac{5}{16}$ in. drill, turn $\frac{9}{16}$ in. length to $\frac{7}{16}$ in. dia. with a roundnose tool, and part off at $\frac{7}{8}$ in. from the end. Reverse in the chuck, turn $\frac{1}{4}$ in. length to $\frac{1}{4}$ in. dia. and screw $\frac{1}{4}$ in. $\times$ 40.

Chuck a piece of $\frac{5}{8}$ in. steel, face, centre, drill No 48 for about $\frac{5}{16}$ in. depth and tap 3/32 in. or 7 BA. Turn $\frac{3}{8}$ in. of the outside to a sliding fit in the socket with a roundnose tool, part off at a full $\frac{1}{2}$ in. from the end, reverse in the chuck and finish off the head to the profile shown.

Put a few 3/32 in. or 7 BA threads on each end of a piece of 3/32 in. silver steel $1\frac{1}{8}$ in. long, screw one end into the tapped hole in the head, wind up the spring from tinned steel wire about 19-gauge and assemble as shown, with a commercial nut on the pin. The buffers are just screwed tightly into the tapped holes in the beam.

A COAL-FIRED BOILER

As some builders of this locomotive wish to fit a coal-fired boiler drawings of a suitable one are shown—and here are some notes on its construction. It is quite simple to make, and a $2\frac{1}{2}$-pint blowlamp or equivalent air-gas blowpipe will do all the necessary brazing. In general the detailed instructions given for *Zoe's* boiler can be followed, working to the dimensions shown here, but I will briefly run through the job as there are points of difference.

The barrel and wrapper cannot be made from a single piece of tube split down and opened out as in *Zoe's* specification owing to the depth of the firebox, so it can either be made with a barrel made from $2\frac{1}{2}$ in. tube, with a separate wrapper of sheet copper, or it may be made wholly from one piece of sheet.

In the former case a piece of 18-gauge seamless copper tube will be needed for the barrel, faced off at each end to an overall length of 5 in. The wrapper needs a piece of 18-gauge sheet copper $8\frac{1}{4}$ in. long and $3\frac{1}{2}$ in. wide. Bend this to the shape and dimensions shown in the cross section. Bend up a ring $\frac{1}{2}$ in. wide from a strip of the same gauge copper, to fit in one end of the barrel. Leave $\frac{1}{4}$ in. projecting, and fix it with a few $\frac{1}{16}$ in. copper rivets. Fit the wrapper to the projection and rivet that likewise. Then in the gap underneath fit an 18-gauge throatplate; this can be flanged up over the bottom part of the backhead former, which is just the same as detailed for the water-tube boiler, but $\frac{3}{16}$ in. longer.

The shell thus assembled can be

brazed up as described for *Zoe*, starting at one bottom corner of the throatplate and working upwards, but when you reach the barrel carry on right around the joint between the barrel and wrapper, and go right on until the junction between the barrel and throatplate is reached. Then start again at the other bottom corner of the throatplate, and this time when you reach the barrel, carry on along the joint between the barrel and throatplate. Give it extra blow-up when you reach the end of the joint so that the brazing material thoroughly amalgamates with that first put on.

Beginners will find that coarse-grade silver solder will flow easier than brazing-strip with a blowlamp of the size mentioned. The job is a piece of cake with a big blowlamp or an oxy-coal-gas blowpipe, using easy-running brazing-strip. If oxy-acetylene equipment is available you can't beat my old favourite Sifbronze. Pickle, wash off and clean up, following *Zoe* instructions.

To make up a sheetmetal shell a piece of 18-gauge sheet copper, 8½ in. × 8¼ in., will be needed. At 3½ in. from the 8¼ in. end cut a snip 1¼ in. long on both sides. First bend the whole sheet to the shape shown in the cross section, then continue bending the 5 in. section ahead of the snips until it forms a circle 2½ in. dia. with about ¼ in. overlap. Put about half a dozen $\frac{1}{16}$ in. copper rivets through the overlap to keep the edges close together, then fit a throatplate as previously mentioned.

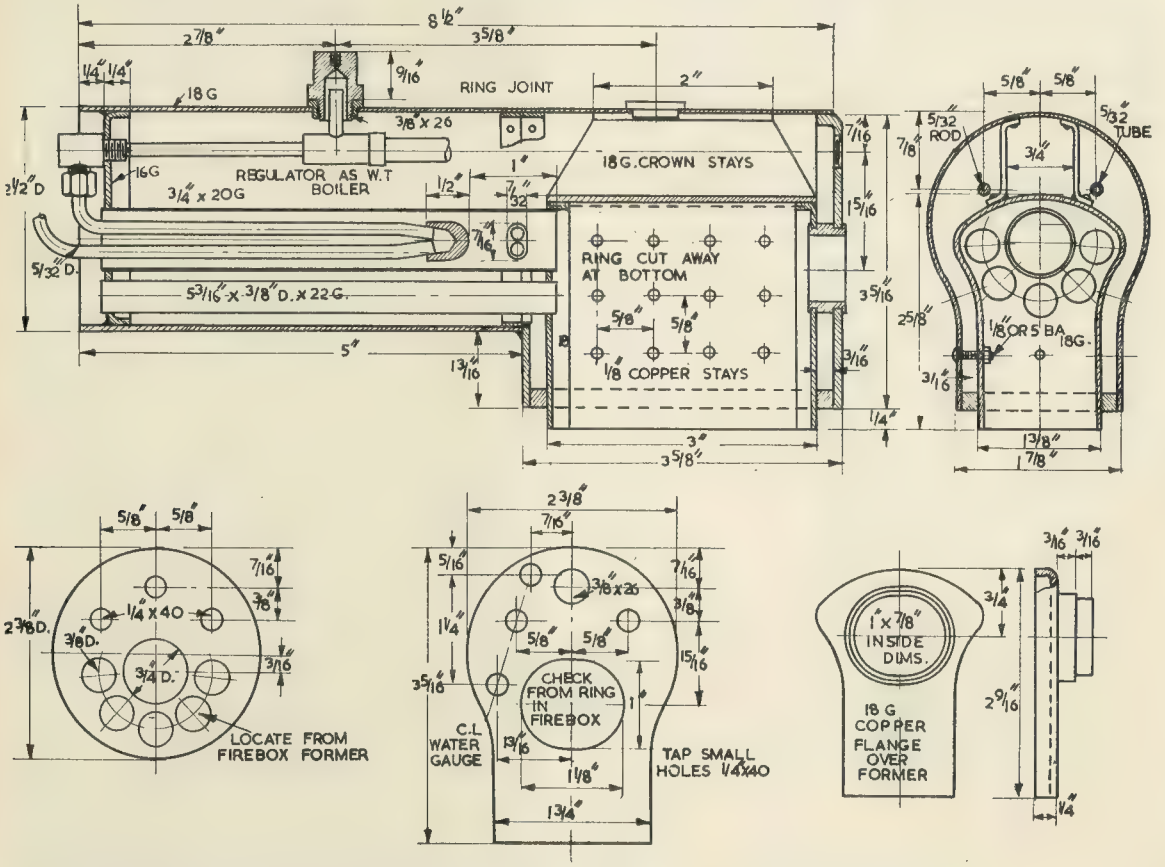
To braze the assembly, first lay the shell on its back in the pan, and, starting at the end of the barrel, go along the longitudinal seam, running in enough brazing-strip or silver solder to sweat right through the joint. Then up-end the shell and do the joint at each side of the throatplate and under the barrel, as described for *Zoe*.

After pickling, washing and cleaning up, check the dimensions, as the brazing job will have probably caused a little distortion, but judicious fettling up will soon put that right !

Cut out the firebox former from ¼ in. iron or steel to the dimensions shown, drill the holes for locating the tubes, then flange the ends of the firebox over it, using 18-gauge copper (plenty thick enough for this little boiler) and allowing ¼ in. for the flanges. To get the length of the sheet forming the sides and crown run a wire around the flange of one of the plates, then straighten it out and cut the sheet to the same length plus 3 in. width.

The holes in the tubeplate are drilled and reamed similar to *Zoe*. To make a firehole ring of the dimensions shown, a piece of copper tube 1⅛ in. × ⅛ in. is needed, but the exact size is of no consequence so long as you can poke a shovel into it without knocking all the black diamonds off.

Chuck the tube and turn a $\frac{1}{16}$ in. step in it $\frac{3}{16}$ in. long, part off at $\frac{9}{16}$ in. from the end, reverse in the chuck and turn a similar step on the other end. Soften the ring and squeeze it oval, then lay it on the doorplate with its centre ⅜ in. from the top. Scribe a line around the flange, cut out the piece, fit the ring and bead over the flange or lip on the inner side of the doorplate.



Longitudinal section of the boiler; cross section through the firebox; the smokebox tubeplate; the backhead and firebox door plate

Bend the sheet, forming the sides and crown, to the shape as illustrated, insert the ends and secure it with a few $\frac{1}{16}$ in. rivets put through the sheet and flanges. Cut out the crown stays from 18-gauge copper and rivet them to the crown at the spacing shown. The whole assembly can then be brazed or silver soldered, using coarse grade, as previously described.

Five $\frac{3}{8}$ in. × 22-gauge tubes are required, and one $\frac{3}{4}$ in. × 20-gauge superheater flue, all $5\frac{3}{16}$ in. long. The smokebox tubeplate is flanged up over a circular former a full $2\frac{1}{4}$ in. dia. and turned to fit the barrel. The tube holes are located from the firebox former and drilled and reamed as shown, then the holes for the steam pipe and stays are drilled and tapped.

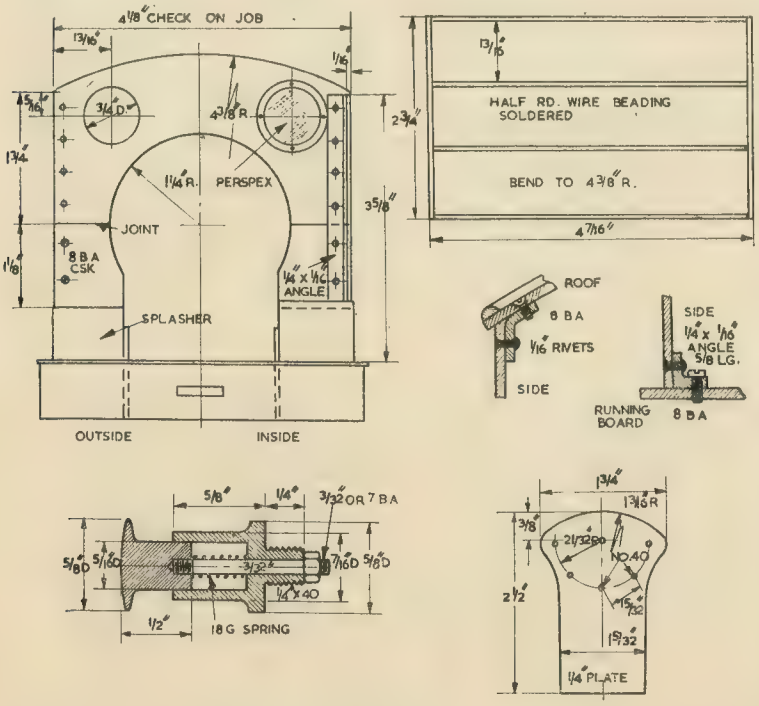
Insert the tubes in the firebox tubeplate, put the smokebox tubeplate on as the spacer and steady, line up the tubes with the sides and top of the firebox, and silver solder the lot at one fell swoop, *Zoe* instructions again.

Fit the front section of the foundation ring between the throatplate flanges, making it from $\frac{3}{16}$ in. square copper rod, then insert the firebox and tube assembly into the shell, riveting the top flanges of the crown stays to the wrapper with four $\frac{1}{16}$ in. rivets in each, and riveting through the bottom of the throatplate, piece of square rod and the firebox tubeplate. If long $\frac{1}{16}$ in. copper rivets are not available use pieces of 16-gauge copper wire.

Fit the smokebox tubeplate (flange first) in the barrel, line up the tubes and holes with a wooden skewer or pencil, and drive the tubeplate in until the tubes project a bare $\frac{1}{16}$ in. Have the tubeplate quite level, then expand the tube ends by driving something tapered, such as a drill shank, into each. If greased this will come out easily.

Beginners should use coarse-grade silver solder for the joint between the smokebox tubeplate and barrel and best grade or Easyflo for the tube ends and crownstay flanges. The job is carried out exactly as described for *Zoe*.

The backhead is flanged up from 12 or 13-gauge sheet copper just like that for the water-tube boiler, but is $\frac{3}{16}$ in. longer, and the holes for fittings are drilled as shown here. To locate the firehole measure from the top and sides of the wrapper to the flange of the firehole ring in the doorplate. Transfer the measurements to the backhead, cut the hole a little undersize and try the backhead in place, when it can immediately be seen if the hole is located correctly. If not it is an easy matter to correct it with a half-round file.



The cab front and attachments; cab roof; the engine buffer; firebox former and tube hole jig

The backhead can then be fitted with the lip of the ring through the hole, the lip being beaten outwards and downwards to clamp the backhead tightly against the ring. See that the wrapper is tight up against the backhead flange all around, then fit the remaining sections of the foundation ring, making them from $\frac{3}{16}$ in. square copper rod, and putting four $\frac{1}{16}$ in. copper rivets through each side and two at the back to hold the parts securely while doing the last brazing job.

Proceed exactly as described for *Zoe*, using coarse-grade silver solder for the job—except the flange of the firehole ring, which should be done with best grade or Easyflo.

Best-grade should also be used for the dome and safety-valve bushes, which may be made and fitted before the final brazing job, and done at the same heating. As there isn't much room for feed clacks on this small backhead fit a couple of bushes turned from $\frac{3}{8}$ in. copper rod and tapped $\frac{1}{4}$ in. × 40 at the front end of the barrel about 1 in. from the end and level with the centre line.

All the staying is done as described for *Zoe*, the blower valve, hollow stay and thoroughfare nipple being made to the drawings given for that engine, except that the length of the stay is approximately $8\frac{1}{4}$ in. to suit the length of the shorter boiler. The solid stay is of similar length and is secured by the usual kind of blind nipple at each end.

The firebox stays are made from $\frac{1}{8}$ in. copper rod screwed through both plates (firebox and wrapper) headed over on the outside and lock-nutted on the inside with thin brass nuts.

Don't forget to use plenty of cutting oil when screwing the stays and tapping the holes to get the threads as perfect as possible. Sweat over all the stayheads and nuts with soft solder, using liquid flux (not paste on any account) keeping the job hot with the blowlamp and spreading the melted solder over all the heads and nuts with a wire brush. Wash well in hot water to remove all traces of the flux, both inside and out.

The boiler can then be tested under water pressure by the method previously described, to a maximum of 160 p.s.i. Then if satisfactory fit the regulator and the superheater. The regulator valve itself, the steam pipe and the gland fitting on the backhead are all made as described for the water-tube boiler, but as steam is taken from the dome in this boiler the valve is located under the dome plug and the lengths of steam pipe and the pipe carrying the regulator rod have to be adjusted accordingly.

●*Continued on page 688*

Do not forget the query coupon on the last page of this issue

READERS' QUERIES

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20 Noel Street, London, W1.

Sail problem

I have made a model of the Prout brothers' *Sheerwater III* catamaran. It is roughly one sixth of the actual size—being 2 ft 9¼ in. long—and each hull is 3¾ in. wide at the greatest beam.

I have tried sailing her with many variations in the sail, position of mast and centre board, but without success. Naturally, with too much sail she blows over (there is no lead on the centre board as I wish to keep it as light as possible). Finding a compromise with regard to the amount of sail is the real problem.—W.B., St Ives, Cornwall.

▲ *It is not usually possible to produce a successful model by scaling down an actual vessel. Displacement varies as the cube of the length and scaling down has an adverse effect on the sailing qualities. The actual catamaran would plane owing to its shallow draft whereas it would be difficult to get the model to do so because of its relatively greater wetted surface. However, fit a centre board on each hull so as to be sure of having at least one well immersed. A little weight at the bottom of the centre board is advisable and if it is made deeper than scale depth less weight can be used.*

By varying the fore and aft position of the mast you should arrive at a satisfactory result. By moving it aft you lessen the tendency of the sails to depress the bows and help the hull to "unstick" itself from the water for planing.

Hielan' Lassie

Could you please supply information on the valve gear of Hielan' Lassie, as follows?

What is the total valve travel?

How much lap and lead is given?

What are the port sizes—and do the inlet ports open fully?

What is the piston stroke?—C.A.S., Lincoln.

▲ *LBSC never divulges the characteristics of his valve gears, i.e. the valve travel, lap, lead, etc. However, working backwards from his drawings of* HIELAN' LASSIE, *his return crank pitch circle is 1 in. dia. The distance from c/l of the expansion link to the eccentric-rod joint is 1⅛ in., and the distance from c/l of link and position of the die in full gear is* $\frac{7}{16}$ *in.*

The valve travel in full gear, therefore, is:

$$1 \times \frac{\frac{7}{16}}{1\frac{1}{8}} = 0.4 \text{ in. approx.}$$

As valve travel $= 2 \times$ *lap* $+$ *port opening*

$= 2 \times$ *lap* $+ 3/32$ *in.*

This makes the lap 0.106 *in.*

The ports are ⅛ *in. steam and exhaust* ¼ *in., and the piston stroke is* 1⅝ *in.*

As to lead, LBSC usually recommends setting to a "black line" at dead centre. This might be anything, but would suggest 0.010 *in. as being about right.*

Wheel-tread angle

In all his publications Henry Greenly says that the treads of railway wheels should be coned one in 20, but he does not make it clear whether this is the total included angle of the cone, or the angle that the tread makes with the axis of the wheel.

You will appreciate that there is a difference of two to one between the two, and as Greenly is very insistent that the angle should not be exceeded, it is obviously necessary that the angle in question should be clear.

I am building a 5-in. gauge railway and am naturally anxious to ensure maximum safety and smooth running. —J.F.V., Cheam, Surrey.

▲ *The angle of one in* 20 *referred to by Greenly is between the axis and the tread; it is not the total included angle. This angle, even in* 5 *in. gauge, is not critical but what is more important as a safety measure is to ensure that a correct radius exists between the flange and the tread, which, in* 5 *in. gauge, should be* 3/32 *in.*

Refrigerators

I am interested in constructing a refrigerator at a low cost. I have a rough idea of the conventional electric motor and compressor principle, but due to the outlay required on these and also the noise of operation I would like to try my hand at constructing either a gas or heater element type.

Could you, therefore, outline the principle of the gas-operated type, giving me some information on which to base my experiments? I would also like to know whether the gas-operated domestic refrigerator is considered cheaper to run than the motor-driven compressor type.—G.D.N., London, W11.

▲ *Gas-operated or absorption-type refrigerators depend for their operation on a delicate balance of liquids and gases contained in the system and, although they are superficially simple in construction, they are, nevertheless, extremely difficult to build and charge properly. It is believed, furthermore, that no one has successfully constructed one in an amateur workshop.*

On the other hand, the motor-driven compressor types of refrigerator appear more complicated, but they are, in fact, far more straightforward in design and much easier to construct. They are also considerably more efficient than the absorption type in relation to the thermal or electrical power supplied.

Components for compressor construction, or completely sealed units either of the compressor or absorption type, are available from Braid Brothers, 50 Birchwood Avenue, Hackbridge, Surrey.

Low pressures only

I have a brass boiler, 2 in. dia., about 20 gauge. The end plates are of very hard brass—not yellow—about ⅜ in. thick. I would like to use it as a water-tube boiler in 2½ in. gauge. Would brass be a satisfactory material, and, if so, what would be a suitable working pressure, and how many water-tubes would you advise? In addition, could a water-tube boiler be coal fired if an iron "fire basket" were used to hold the fire and prevent the heat from reaching the paint on the outer casing?—K.A.P., Greenford, Middx.

▲ *The brass boiler described would only be suitable for low pressure work using spirit firing (not more than* 40 *lb.). For higher pressures, copper is essential. Water-tubes could be added to the boiler to increase the rate of steaming provided that no soft solder has been used in its construction (about four tubes* ¼ *in. dia.).*

It is not practicable to use coal-firing with a water-tube boiler. It has been done, but with indifferent results. The trouble is that an enormous amount of heat is lost at the sides of the furnace, and it is difficult to arrange for a suitable blast and ashpan. Finally, the reserve of steam would be very limited.

CYLINDER LUBRICATION
for model steam engines

Yet another of those sticky problems, but one which KYRLE W. WILLANS tackles in characteristic style

RELIABLE cylinder lubrication is indispensable for highly developed model engines and particularly for those using superheated steam as the working fluid. As the problem is to supply steam in an " oily condition " and not to supply doses of oil alternating with dry steam, accurate metering of the oil supply is essential.

The problem is not a new one by any means and, speaking as one who in days gone by owned and operated both traction engines and steam ploughing engines, the difference in running between the hit-and-miss lubrication by a displacement lubricator and the steady supply through a mechanical lubricator is considerable. On the top of this the life of gland packings is lengthened materially if a mechanical lubricator is fitted.

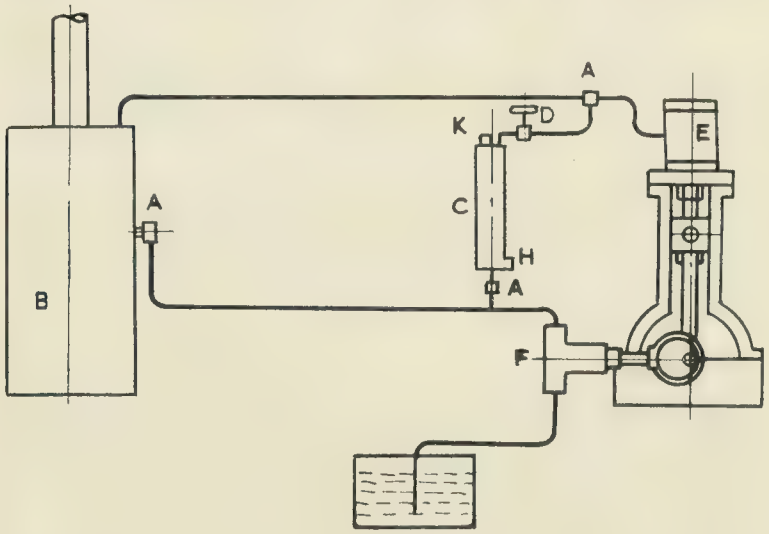
I spent my apprenticeship building traction engines in the dim, far-off days, when work started at 6 a.m. and a good proportion of machining was carried out by hammer and chisel ! Mechanical lubricators had not then been fitted to traction engines, though in the case of high-class road locomotives built by the firm for special customers, sight-feed lubricators were mounted on the spectacle plate. But the general impression was that they did not withstand the jolting and rough use that the engine had to put up with.

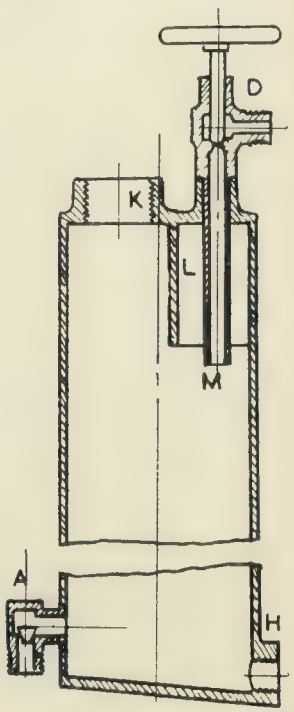
Even in later days as a steam plough owner, I found it difficult to get the drivers to realise that if you did not drain the oil reservoir methodically the oil pump had to pump water which it did not find agreeable. The oil, floating on the top, gave a false reading and never got where it was needed.

The same defect was present in the Stanley steam cars sold up to the first world war. In these models there was no means of draining the water from the oil tank under the footboard except by disconnecting the pipe connecting the tank to the lubricating pump.

I well remember the mechanical lubricator fitted to the first Stanley I possessed. This was a very early model of the 10 h.p. type and the mechanical lubricator, of the cocking and firing type, was most attractive. A ratchet mechanism made the suction stroke slowly and steadily against a spring; the delivery stroke, on the other hand, was made rapidly by the action of the spring. On the top of everything the pump could be operated by hand if the footboard was lifted and a dose of oil put into the steam pipe before starting out.

I would like now to suggest a means of combining a sight-feed lubricator with the positive action of





A A A *check valves*
B *boiler*
C *oil reservoir*
D *needle valve*
E *engine*
F *boiler feed pump*
G *feed tank*
H *drain plug on oil reservoir*
K *filling plug*
L *air chamber*
M *oil passage leading to the needle valve*

a pump, the flow of oil being adjusted by means of a needle valve; the sight of a beautiful globule of oil passing through water indicates that the oil is going where it will do the most good.

Advantage is taken of the fact that the pressure at any time in the feed-pump delivery pipe exceeds the pressure in the steam pipe between the stop valve and the engine. That being so, it follows that if you were to connect a branch from the feed pump to the steam pipe adjacent to the valve chest of the engine, and fit an oil reservoir in this branch pipe with a needle valve and a sight feed glass, you could deliver a steady amount of oil to the engine. Incidentally, you could deliver graphite in suspension in water.

Oil, however, is ideal in view of the fact that it floats on water. That being so, no water could pass to the engine until all the oil had flowed from the reservoir. It seems reasonable to assume that such a lubricator might be used in cases where the boiler is fed by an injector, but that is a matter which awaits the opinion of a locomotive authority.

Says the critic, what happens when the feed pump is not delivering water to the boiler ? True, that during the periods when the pump by-pass is open and the water is returning to the feed tank, no oil will be delivered to the engine. The remedy, however, is simple, in view of the very small amount of oil leaving the oil reservoir.

The oil reservoir is so designed that a small amount of air is trapped, preferably in a neoprene bag, as in the case of the NRDC/Ricardo feed pump, and a check valve is fitted between the feed pump and the oil reservoir. In flash boilers, however, where the boiler pressure is controlled by the presence of a relief valve in the feed line, the air chamber would not be required, provided the relief valve was used to control steam pressure and the pump was continually delivering against that pressure.

It is obvious that within a very wide range the position of the needle valve, which controls the flow of oil, and the sight glass, which shows the rate of flow, can suit the job. The oil reservoir, naturally, should be as long as possible and its diameter as small as possible, consistent with a reasonable oil capacity.

My diagram gives the piping arrangement. To enable the reservoir to be refilled with the engine running, a drain cock at the bottom of the reservoir, a filling plug at the top, and a shut-off valve on the pipe from the feed pump would be required.

The needle valve could be closed to prevent steam backing down the oil pipe from the engine, or a check valve could be fitted at the junction of the oil pipe to the steam pipe. ▣

Boiler from scrap

By E. D. Howell

THIS is an attempt to copy the boiler published in MODEL ENGINEER of 10 January 1957. The differences are due to the material used.

A flywheel magneto case with a pressed-steel ball bearing housing—it has a steel disc inside and 14 copper $\frac{3}{8}$ in. tubes—forms the crown of the inner shell of the firebox, the flue being a 2 in. iron water pipe.

The crown for the outer shell is a half crankcase (from a larger motorcycle), the rim being made to the same circumference by reinforced molten aluminium alloy.

All bolting lugs had to be sawn off close to the rim in order to finish in the $4\frac{1}{2}$ in. centre, the lathe diameter over the rim being 8 in. The diameter of the firebox crown was 7 in., thus deciding the size of the shell plates and allowing a useful water space.

The foundation ring was then fitted, and the bolting lugs, with a bit of flange attached (sawn off the other half of the crankcase), formed ready-made housings for the boiler fittings.

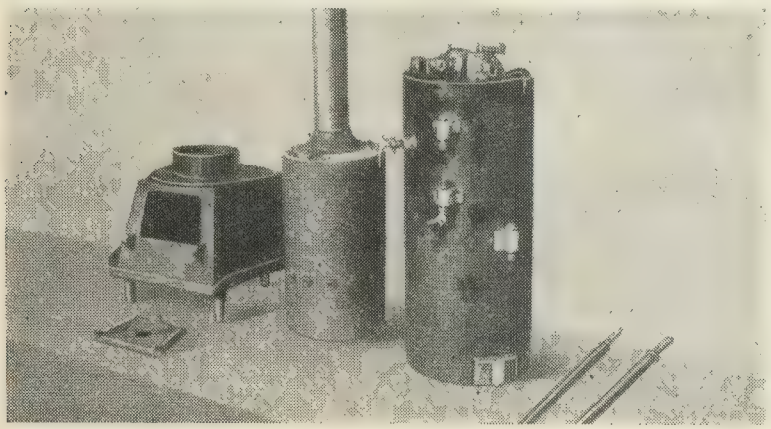
The furnace is a laundry stove—formerly used for heating flat irons.

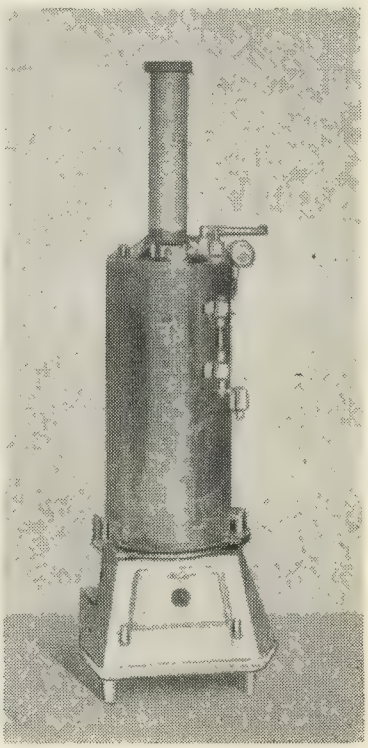
The flue connection was sawn off the top otherwise it would have obstructed the boiler. It was made up in the centre with a 2 in. length of 4 in. steel tube.

A bolting ring was next made for fixing the boiler to the furnace—from flat-spring steel off a vehicle advertised as a "Pedigree high pram," of which, perhaps, at 86 I may have no further use.

The two straight lines (see picture) are the two axles from which the foundation ring was made. The boiler height's inner shell is 12 in.; the outer 18 in. Both are of 12-gauge steel.

All joints are force-fitted (not coal-hammer type) by vice and heavy cramp pressure. ▣





1957 National

Northerner reports, in caption form, on the Midlands loco event of the year

Left: Twelve-year-old George White is evidently quite a veteran by the way he handles the controls. He is driving the nicely-finished 3½ in. gauge County class GWR 4-4-0 built by T. E. Cave, of Bridgwater

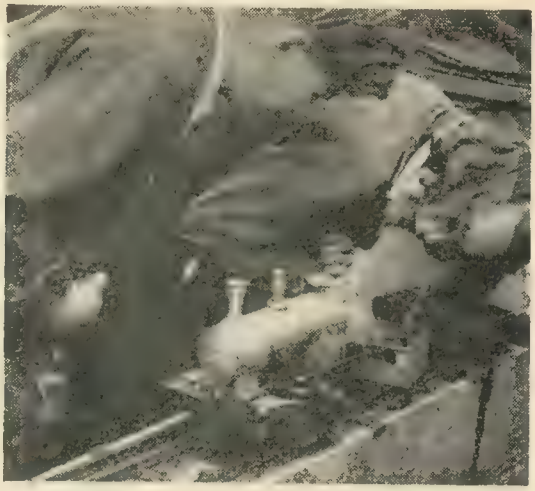
Left: A narrow-gauge industrial tank engine ought by its very proportions to have a good performance, and the Peckett built by S. J. Applewhite certainly helps to prove the rule. In fact, it was disappointing that there was no hill climb at Birmingham!

Above: Well-proportioned and handsome, this 5 in. gauge LMS 0-6-0 was built by F. E. Cole, of Leicester, who is seen here at the steam-raising bays. In passing, how engine sizes grow—25 years ago, 3½ in. was considered a "big" engine and 5 in. was too large for most people to tackle

Left: LBSC's BRITANNIA *is deservedly popular and this particular example was built by Jeffrey Stubbs, of Wakefield, as a "first attempt." Jeffrey has since built the 7¼ in. gauge tank illustrated earlier this year in my Brighouse report, when I gave Jeffrey the wrong Christian name*

Rally at Birmingham

Above: NETTA *is now being seen in increasing numbers at club events, and this 5 in. gauge sample was built by her driver, D. English, of Wakefield. Donald made his own patterns and castings for this 0-8-0 tender locomotive*



Above: *Husband John H. Daltry, of Rugby, watches critically as wife Ruth raises steam in her partly-finished* TICH, *which, though not yet run in, goes well on the track*

Left: *G. M. Cashmore, of North London, is making a really well-detailed job of his LNWR* GEORGE THE FIFTH. *Built to 5 in. gauge the engine is partly to the works drawings and partly to LBSC's design for the* MAID OF KENT

Below: *This 5 in. gauge "Black Five" was built by G. C. Nicholson (seen oiling the motion), using his own drawings, patterns and castings, but the valve-gear details were worked out by S. J. Applewhite. Recently the engine earned £25 in one day's work for the "Cheshire" homes*

In the ME Workshop

This week, in his second article, EXACTUS describes the pattern making and the connecting-rod machining for the rebuilt hacksaw machine

THE new crankpin was a straightforward turning job. A piece of $\frac{5}{8}$ in. dia. mild steel $2\frac{1}{4}$ in. long was placed in the three-jaw and one end turned down to $\frac{3}{8}$ in. dia. for the length of 1 in.

Using the tailstock die holder and a $\frac{3}{8}$ in. BSF die the crank pin was then threaded to take a standard $\frac{3}{8}$ in. BSF nut, leaving a shoulder of $\frac{1}{4}$ in. plain. I then removed it from the chuck and placed the $\frac{3}{8}$ in. dia. in so as to turn the other end to the sizes and dimensions shown in the illustration (Fig. 7). The small end pin was also turned from a piece of $\frac{5}{8}$ in. dia mild steel.

A piece of larger material was needed for the retaining washer and as I had a piece of $1\frac{1}{2}$ in. dia. this filled the bill admirably. There were no machining difficulties.

These little bits and pieces finished, I got down to tackle the pattern for the connecting-rod. It was fabricated from some odd pieces of wood. The centre piece was shaped from a size 9 in. $\times$ $1\frac{1}{8}$ in. $\times$ $\frac{5}{16}$ in. and the sides to complete the I-section from two pieces 9 in. $\times$ $\frac{5}{8}$ in. $\times$ $\frac{1}{8}$ in. The two bosses for big-end and small-end were shaped up in the lathe and the big-end boss was drilled $\frac{1}{2}$ in. for a dowel to provide a core hole.

When all the parts were completed I glued them together with Seccotine and made the small fillets from Polyfilla. A coat of priming paint was then applied. When dry the job was lightly sandpapered followed by a coat of flat black paint to finish it off. The illustration in Fig. 8 shows the pattern before assembly and Fig. 9 the finished pattern and a casting.

The connecting-rod was cast in aluminium by F. Bowman, of Clerkenwell, and although the metal itself was easy to machine the set-up for the job presented a problem.

Owing to the length of the rod it was impossible to swing it on a faceplate to bore the small-ends and big-ends so a method had to be devised using the saddle and cross slide. Even then it became obvious that I would not be able to machine the two bores at one setting. When two holes have to be bored accurately and parallel to one another a common or datum face must be machined first.

I decided to take a cut over the face of the ribs of the I-section and work from there. The first set-up was to bolt the connecting-rod to a flat strip of metal and bolt this to the vertical slide. The vertical slide was set round to 90 deg. so as to feed parallel with the cross slide, and this gave me the advantage of being able to face the rod at one setting.

When I made the pattern for the connecting-rod I made the big-end and small-end bosses the same thickness so that the rod would bolt parallel to the metal strip without additional packing. The casting was a good one and it took very little to clean up the bosses to make them sit flat.

I marked off the hole centre of the small-end from the big-end and drilled a $\frac{5}{16}$ in. hole to bolt the rod to the metal bar. The other end was attached by a bolt passing through the cored hole. When this was set up on the cross slide and checked with a test-dial indicator for parallel, a light cut was taken over the ribs of the I-section.

The tool bit in the flycutter for this operation was a $\frac{1}{4}$ in. dia. piece of silver steel, shaped, hardened and tempered and held in a holder by a $\frac{1}{4}$ in. Whit. Allen grubscrew. The holder is a piece of 1 in. $\times$ $\frac{1}{2}$ in. mild steel bar $4\frac{1}{2}$ in. long held in the independent four-jaw chuck. It was not specially made for this job—only the silver steel tool bit.

The flycutter has seen long service in the workshop and is a very useful tool. When the cut was complete the rod was turned round and the other side given the same treatment.

There was a difference in the securing for the second cut. Instead of clamping the bosses directly to the mild-steel bar, I placed my hardened and ground parallel strips between the newly-machined face and the bar and as close to the bosses as possible. I soon had the main section of the rod machined both sides and parallel to each other. Fig. 10 shows the flycutter as used for facing the big-end boss.

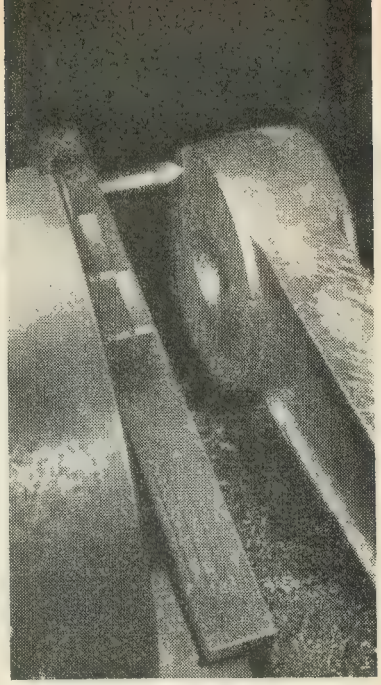
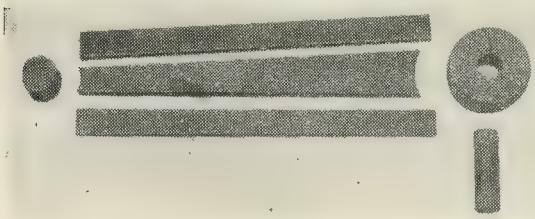
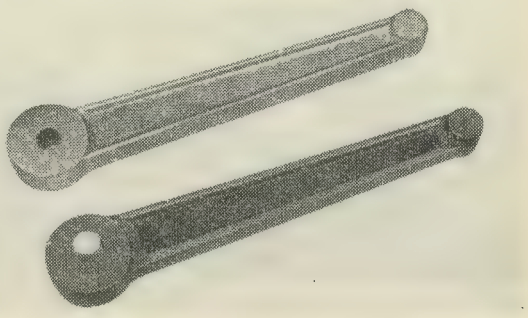


Fig. 10: The flycutter facing the big-end boss

Fig. 9: The finished pattern and casting

Fig. 8: The connecting-rod pattern before assembly





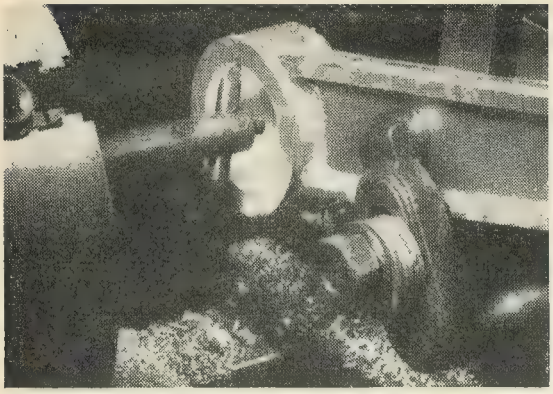


Fig. 11: Boring the big-end for the ball race

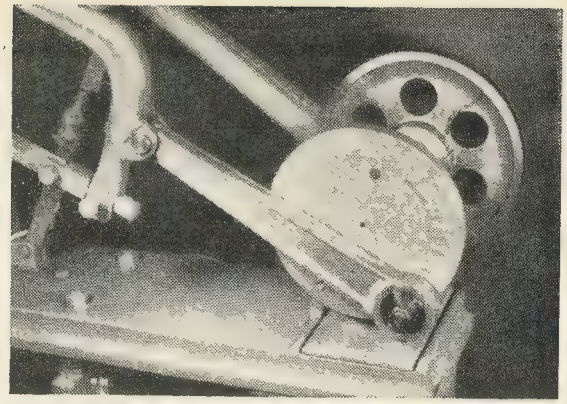


Fig. 12: The finished connecting-rod in position on the saw

I was now able to clamp the connecting-rod directly to the vertical slide. One of the clamps can be clearly seen in Fig. 11. The job was now a lot easier to handle for setting up. With the flycutter still in the chuck I faced off the big-end and small-end bosses to size.

The boring of the small-end was, perhaps, the easiest job. To set it in position a piece of $\frac{5}{16}$ in. dia. silver steel was gripped in the three-jaw chuck, the four-jaw now being removed, and the hole in the small-end located over the silver steel. The nuts were lightly tightened; the small-end was located over the silver steel easily when the saddle was traversed backwards and forwards, then the nuts were given a final nip up.

Everything was now ready to finish the small-end. A U-drill was held in the three-jaw and run through the $\frac{5}{16}$ in. hole; this was followed by a $\frac{3}{8}$ in. reamer.

The boring of the big-end was a little more involved. A hole $1\frac{3}{8}$ in. dia. and $\frac{3}{4}$ in. deep had to be bored to accommodate the ball race. A flange $\frac{1}{8}$ in. thick was left at the bottom of the hole for the race to butt up against and also to act as a dust cover in helping to protect the ball race from any foreign bodies.

The centre of the flange needed a $\frac{5}{8}$ in. hole to fit over its corresponding diameter on the crankpin. The connecting-rod was lined up for boring in a similar fashion as was used for the small-end, and instead of the $\frac{5}{16}$ in. silver steel held in the chuck, the chuck was removed and a hardened centre inserted in the lathe mandrel nose. The cored hole in the connecting-rod was then seated by self alignment on the centre and the clamping bolts tightened up.

It may be thought that this method is not very accurate in maintaining the centre dimensions of the small-end and big-end. In this particular instance any slight difference either way would not have mattered a great deal as there is sufficient travel at each end of the guide rails to accommodate any error.

Anyway the 10 in. centres came out nicely, as I had already marked off the centres when I first drilled the small-end hole.

In the case of my connecting-rod I was fortunate in having my cored hole nicely in the centre of the boss and so made it easy to set up as I have described with the use of the centre. Had I been less fortunate with the position of my cored hole I would have had to set it so that the finished bore was as concentric as possible with the outer diameter of the boss. I have seen many jobs spoilt merely because this policy is not adopted. In Fig. 11 it can be clearly seen that the bore is central with the boss, leaving an even wall of metal all round the bore.

My boring tool was made from a piece of $\frac{5}{8}$ in. dia. mild steel for the holder and a piece of silver steel hardened, tempered and ground for the cutting tool. The tool was held in the four-jaw chuck which enabled me to get a fine adjustment for my finishing cut. For roughing out the bore I moved the tool out of its holder for each cut.

The correct depth was maintained by bringing the saddle up to a stop on the lathe bed. Before the boring was started I ran a 19/32 in. drill through the cored hole and followed this with a $\frac{5}{8}$ in. reamer.

● *To be continued*

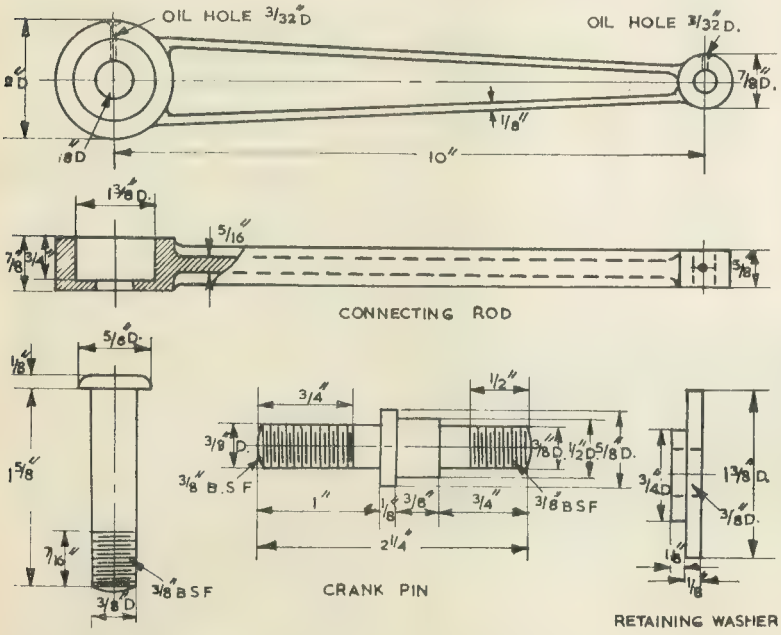


Fig. 7: The connecting-rod details

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

EVERLASTING !

SIR,—If Mr G. H. W. Randell [Postbag, October 24] will tell me what metals he used in his coupling and connecting rods, which, he says, show no signs of wear after carrying 200,000 passengers during thirty years' service, I will be more than grateful. It's just the stuff I am looking for.

I have four locomotives—two 7¼ in. and two 5 in. gauge—and quarter mile of continuous elevated track. I have carried many thousands of passengers but far short of Mr Randell's number.

My engines all show signs of wear, and one 7¼ in. gauge has been re-brassed. Bearings are all chill cast phospher bronze running on polished silver-steel crank-pins.

Grangetown, Yorks. L. HAWKES.

A PACERA

SIR,—Martin Cleeve [ME, October 17, page 542] inquires the maker's name of the machine saw. This is, I believe, a Pacera. Buck and Hickman might know the maker.

The marks on the cut-face are, of course, chatter, which persists; in this case, apparently the saw was stopped about three-quarters through and restarting (at slower speed) got rid of it.

Chelmsford, Essex. G. BERKELEY.

OLD TIMES' SAKE

SIR,—A first attempt, my model of a South African Railway K class tank was awarded a Certificate of Merit at the Rand Easter Show organised by the Rand Society of Model Engineers.

I am a retired engine driver of the SA Railways and during the middle 30s I drove the prototype for about three years, and it was one of the best I ever handled. I always promised myself I would model this locomotive, perhaps for old times' sake.

There is a story attached to this type of locomotive. They were acquired by the SAR due to a peculiar set of circumstances. They were built shortly before World War I for the Manilla Government Railways but a revolution in that country found them left on the maker's hands. The SAR, being short of locomotives at the time, took them over. They gave very good service on passenger and goods trains and were withdrawn from service at the outbreak of World War II.

I look forward every week to ME and thoroughly enjoy every article.

Johannesburg, S Africa. A. E. DAVIES.

SPITFIRE

SIR,—The replies by Roger Nolan and B. Slater [Postbag, October 24] to my letter concerning the Spitfire are deservedly scathing owing to their seeing my letter in its published form. However, the photo-recce version of the Spitfire to which I referred was intended to read as Mk XI, and not, as published, as Mk II. This was entirely due to my own carelessness when drafting my original letter. I make no excuses for myself on that score, and take off my hat to both Mr Nolan and Mr Slater for their respective gen-packed letters.

Now that I have eaten humble pie, I wish to add that if Mr Nolan would glance at the Exhibition catalogue, he will agree with me that his model *is* listed as Mk XI, or at least, that it reads as such.

In my earlier letter I stated that no Mk II carried cannon guns, and once again I bow to superior knowledge, as my source of information, which is Volume IV of *Aircraft of the Fighting Powers*, states that the Mk III was the first to carry cannon, but having faulted this publication on other aircraft, in respect to armament, I should have been wary.

Nevertheless, Mr Nolan, I am still irritated over the classification "Pursuit" and also over your claim of "One of the last Spitfires to fly!" The last of the few be blowed !

STANLEY H. MURDOCK.

Model of a South African Railways K class tank built by A. E. Davies. It was awarded a certificate of merit by the Rand Society of Model Engineers at the Easter Show

OLD TIMER'S TIP

SIR,—Geometer's comments [Beginner's Workshop, August 15] regarding the method of freeing taper ball stems brings to mind a tip which was given to me by an old time motor mechanic.

Removal of these taper stems sometimes presents severe difficulty but a sure and effective method is to hold a heavy hammer against one side of the socket while hitting the opposite side and in that manner gradually working around the circumference of the part having the taper recess in it so that the metal is actually stretched slightly and when this condition is attained the taper ball stem will drop out.

I appreciate that MODEL ENGINEER is not a motor trade journal but in that Geometer has referred to the matter the foregoing comments may be of interest and assistance to your readers.

Melbourne, Australia. W. H. MACMAHON.

STROUDLEY'S ENGINES

SIR,—I fully appreciate R. A. Holder's feelings [Postbag, October 17] in this matter, but he will find that I did say in my article that I was tempted, the Gladstones did live a very smug and sheltered life, and I could not resist a dig at them.

I am not awfully impressed with the seeming effort needed for suburban work with close stops. Does Mr Holder remember the SECR Mid-

Kent line in the early 1900s ? I lived at Beckenham then when a lot of Stirling's 7 ft 4-4-0 " express " locomotives were used on the trains in turn with the tank engines. These big wheeled machines handled the trains with a verve and dash that was quite remarkable. They got away as well as the tanks and they blew off hard at every stop. They were not pushed on the rather long run from London Bridge to Ladywell, but from there to New Beckenham they were in their element. For the present generation's information these 4-4-0s were about the duddest express engines that were ever made !

This is not to suggest that I have anything against the Terriers, which in my opinion were Stroudley's masterpiece. They were designed for a specific job with a lot of difficult conditions necessitating an unorthodox approach, and the result was pretty near perfection.

Bexhill-on-Sea; C. M. KEILLER.
Sussex.

" WELL SET UP "

SIR,—The prototype of my 1½ in. scale Brown and May traction engine was one of the last engines made at the North Wilts Foundry, Devizes, before they closed down in 1912, and for many years I was closely associated with it and have both driven it and carried out mechanical repairs to it in the years before the last war.

I chose to model this engine for a number of reasons. First, although simple in design, the workmanship was of a very high standard and, in the words of an old engineman, she was " well set up." Brown and May entered the traction engine business rather later than most firms, being primarily builders of portable and semi-portable engines, which were shipped all over the world.

Even in the early engines the cylinder was mounted on a cast-iron saddle plate, the top flat surface being planed, and steam was fed into the cylinder block by means of a cast elbow, which was the only steam joint to be broken if the cylinder had to be taken from the boiler.

The eccentric rods were turned and polished, and not flat section as with most other makes. The big-end bearing of the traction engines (but not road locomotives) was of the marine type, fitted with a handsome sight-glass lubricator. The feed pump eccentric rod was turned and a ball machined on the end which fitted a socket joint in the pump ram; a very nice piece of machining for those days.

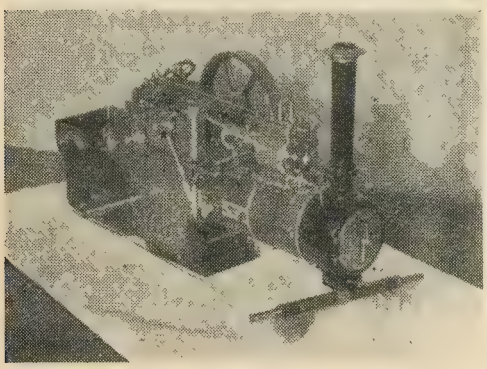
The prototype was not sprung, although Brown and May did fit a sprung footplate at extra cost. My engine, however, did not have one, and to those who have never travelled the Queen's Highway on an unsprung traction engine, the noise and jar is unbelievable, and above all can be heard the sharp " dufter-dufter " of the exhaust.

This fine old engine had a hard working life, and when in 1947 her services were no longer required, she was mechanically as good as new, and it was a pity to see her once polished motion work red with rust and her brasswork green. However, in a way she did escape the scrap-yard, and her boiler now supplies steam for a market-gardener.

I have kept as close to the prototype as possible, but as the model is for work and not a glass case, I have had to make one or two modifications. The flywheel rim is much thicker than scale, and the blower-pipe is led into the smokebox and not into the chimney stump as in the full size. When complete, she will have a Pickering-type quick speed governor.

The boiler has been tested to 180 p.s.i.

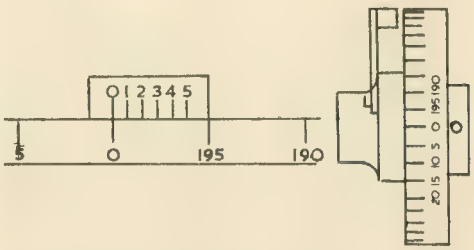
Salisbury, M. SPEAREY.
Wilts.



Mr M. Spearey's 1½ in. scale model of a Brown and May traction engine

LATHE MODIFICATIONS

SIR,—Mr F. Wood [Postbag, September 19] forgets that the gear train on the Littlejohn lathe precludes the setting up of the train he suggests. Neither are any of these size gears supplied with the lathe as standard. Bearing all this in mind, Mr Nixon's solution appears to be a good way out of the difficulty.



Mr Charles Buist's device for avoiding mental arithmetic

Some years ago, before I had a proper dividing head, I managed the job by putting a strip of drawing paper around the periphery of the faceplate, the overlapping ends being cut square with an old razor blade. This strip was then laid flat and divided into 125. This was not so formidable as it sounds as $5 \times 5 \times 5 = 125$.

The strip was attached to the faceplate with gum, a simple pointer was clamped to the bed and all was set for the actual dividing. This idea is not original, merely another adaptation of similar devices described many times in earlier MEs.

As a well satisfied user of a Littlejohn lathe for over 10 years I greatly enjoyed Mr Nixon's articles and will profit by them. May I offer him, in return, details of some " mods " I have made in the hope that they will be of interest ?

(1) The topslide is fitted with only three screws to the jib pieces. I added two more equidistant between these three and then replaced the centre one with a thumbscrew for locking the slide solid. This prevents the slide running out of cut, as it will do when facing unless the jib piece is so tightened up as to give stiff working which is not nice for ordinary use.

(2) A similar thumbscrew was fitted to the cross slide. This fitted central on side of slide nearer to headstock as it would be inaccessible on the

POSTBAG . . .

tailstock side. It needs a small copper disc to prevent damage to the slide. This, also, is essential when doing a job mounted on saddle with a boring bar between centres.

(3) I made rows of holes (24 and 30) around the periphery of the back plate of the s.c. chuck. These, with a simple finger made of $\frac{1}{16}$ in. flat steel attached to the lathe bed, give an ever ready means of simple dividing for such things as castellated gland nuts, holes in eye end covers, hexagons and squares, etc.

(4) I replaced the dial on the cross slide with a larger one, $2\frac{1}{2}$ in. in my case, and divided it into 40, numbered as the enclosed sketch. These divisions now represent five thou on the *diameter* of the job in hand instead of on the *radius* as is usual. The advantage of this will, at once, be apparent. If the mike says 15 thou off, well, 15 thou it is on the dial. No mental calculations or pencil and paper required. The single thous are taken care of by the "vernier" piece attached to the back of the bearing for cross slide.

If Mr Nixon or any other reader wishes to make this "mod" and has not the facilities for doing the dividing accurately I will be only too pleased to do it for them.

Again, this idea is not original, being copied from a Swiss tool room lathe on which it appears to be standard practice.

Alnmouth, CHARLES G. S. BUIST.
Northumberland.

TWO-SPEED PLOUGHERS

SIR,—Although I took the accompanying photographs some years ago I thought they might interest readers.

The main point of interest is the two-speed ploughing gear. Two makes of engine are shown, Fowler and McLaren. The Fowler two-speed consists of twin bevel gears on the crankshaft, with meshing bevels on the upright drive to the winding drum, either of which can be brought into mesh with its fellow on the crankshaft.

The McLaren two-speed is effected with two fixed pinions on the upright drive to the drum, either of which can receive the drive from a corresponding gear sliding on the second upright shaft, which is driven from the crankshaft in the normal way.

These engines, derelict, were photographed about six or seven years ago near Ramsbury in Wiltshire.

Cirencester, PETER W. FLEXEN.
Glos.

STEAM CAR

SIR,—H. Claydon ["Modern Steam Car," October 3] deserves our thanks for his experiments and for keeping alive interest in the steam car but why does he retain most of the disadvantages of the petrol car?

By adding one cylinder only, the self starter, clutch and gearbox can be dispensed with. Using slightly larger bores, we can have the advantage of a slow revving engine and silence, and cast-iron pistons, allowing smaller clearances. Adding exhaust valves would do away with the harmful high compression of the Uniflow engine.

Water inlet valves of ample area, with small lift, would cure water hammer and save the complicated multi-plunger type; one plunger only would serve. And why use 30 watts for the blower, when a self induced draught can be satisfactory?

I do not wish to belittle Mr Claydon's efforts but he is bypassing all the advantages of the steam car. I cannot call to mind any steam car from 1900 onwards that was not superior in most ways.

Maidstone, CHARLES E. HOOKER.
Kent.

The Fowler (extreme left) and McLaren ploughing engines. See the letter from Mr Peter Flexen

PUZZLING FEATURES

SIR,—Mr Mansell's picture [Postbag, September 26] of the Great Orme Railway winding engine was very interesting.

Some features of this interesting little railway puzzle me; it is, of course, a cable railway, but how do the cars maintain contact with the cable when negotiating curves and loops?

Also the line is in two sections, with the winding engine halfway up the total length of the track, necessitating changing cars to reach the top; why isn't the power-house situated at the extreme top of the line?

As it is steam-operated, what is the purpose of the trolley-arm and overhead wire?

Taking our thoughts to a higher and more topical "track," I was very disappointed to see that the Russians, with their artificial satellites, have beaten Michael Oxley in the realm of space flight. Perhaps he will tell us, in time for Christmas, how he has succeeded in putting rings around the Red Moon.

Thurmaston, JOHN H. DURANCE.
Leicester.

We believe Academician Oxley has finished his satellite and he is now installing the steam engine. Incidentally, his movements have taken him out of our orbit; we would like to know his whereabouts in the universe. —EDITOR.

ROSE . . .

Continued from page 678

The actual lengths can easily be ascertained from the boiler. Instead of the three holes in the top of the regulator barrel, a No 30 hole is drilled in it exactly under the middle of the dome bush, tapped 5/32 in. × 40, and a piece of 5/32 in. pipe $\frac{1}{2}$ in. long screwed into it. A cap is turned from $\frac{5}{8}$ in. brass rod to the dimensions shown and drilled $\frac{1}{4}$ in. to fit over the pipe, thus ensuring that the steam going down the pipe is quite dry.

The union elbow at the smokebox tubeplate is the same as that specified for the water-tube boiler, but instead of a loop the usual element is fitted, with a block bend at the end as shown.

This is made from a $\frac{1}{2}$ in. length of $\frac{1}{2}$ in. × $\frac{1}{4}$ in. copper rod and drilled as shown. Braze the ends of the 5/32 in. elements into it and then file to the outline given.

The end of the lower tube is bent to a swan-neck, exactly the same as on the water-tube boiler, and furnished with a union nut and cone for connecting to the vertical pipe on the steamchest.

● *To be continued*

CLUB NEWS

FACED with the difficulties of declining membership and rising finance, Hull Model Power Boat Club has merged with Hull Group of the International Radio Controlled Models Society. This means that the members will turn from free-sailing to radio-control.

Membership of the club had been declining over the past three years. Large notices in the local model shops, tool shops and public libraries brought in two members in two years while the old members resigned at the rate of six a year—despite the exceptionally attractive facilities which the club enjoyed.

In particular, the club had the friendly support of the local council.

Edited by
THE CLUBMAN

About fifty yards from the concrete-based pond the council converted a wartime decontamination centre into a boat store and club room. The club agreed to take part in the local regatta and to sail as much as possible on Sundays for the pleasure of the public, and the council in turn gave its utmost help to the club's own regattas. But it became clear that, with the exception of the part played by two or three members, the flag was kept flying by the radio-control section.

The number of radio-controlled craft has increased steadily in the past five years, and last April the Hull Group of the IRCMS was founded. Ten of the group's twelve members were MPBC men and the two associations had the same secretary and treasurer. There were now only six free-sailers in the old club, yet the new group had to make separate arrangements with the Parks Department (as, for example, when the Group was meeting the Manchester and Tyneside Groups in July) and to ask the club's permission for the use of its headquarters.

In response to a request by Chairman R. Witty, of the Hull MPBC (a non-radio member), a meeting was held in East Park to discuss the club's future. Mr Witty said that, just as model power boats had broken away from model yacht clubs, so the radio-controlled craft were now taking over from the free-sailing models. Radio-control, in his opinion, challenged the model engineer to greater efforts in that, with the ever-increasing use of the crystal-controlled superhet receiver and transmitter, a near-perfect method of passing intelligence to the model had been achieved. It was now for the model engineer to provide a reliable compact intergear so that the model would be truly a working one.

"NOTHING BUT GAIN"

There was, he thought, a choice of two courses. The free-sailing members could run the club, with its commitments to the Parks Department, or Hull Group of the IRCMS could take it over, the free-sailing members subscribing £1 a year with the condition that immediately the model was radio-controlled they would become full members of the IRCMS and pay the half-guinea subscription to headquarters.

The free-sailing members voted in favour of the take-over. I like the comment added by D. Greene, secretary of the Group (18 Fitzroy Street, Hull): "The Hull Group IRCMS does not regard this as a victory but rather as a sensible agreement between two clubs which can result in nothing but gain, both to themselves and the public."

ME DIARY

November 14 Hull SME junk sale.

November 15 Rochdale SMEE general meeting, Lea Hall, 7.30 p.m.
Warrington and District MEC design of new portable track; discussion.

November 16 SMEE "Inspection Tests on Small Lathes," Col. Marchment. Nomination day. Pepys House, Westminster, 2.30 p.m.

November 17 MRCA at Boscombe (postponed from November 3).

November 22 Malden SME film show.
Thames Shiplovers and Ship Model Society "Battle of the River Plate," Dudley Pope (the author), Baltic Exchange, London, 6.30 p.m.

November 23 Bristol SMEE Members' Exhibition Night; five cups will be awarded. Folk House, 7.30 p.m.
Institution of Engineering Designers visit to Associated Lead, Elswick, Newcastle upon Tyne, 10 a.m.

November 27 Birmingham SME visit to Johnson Matthey for welding lecture, 7.30 p.m.

November 28 Gauge 1 MRA, Gauge 1 track night of MRC, Hammersmith.
Hull SME Brains Trust.

November 30 West Riding SLS annual social, Guildford Hotel, Leeds, 3 p.m.

December 6 Thames Shiplovers club night, Oddi's Restaurant, Coptic Street, London, 7.0 p.m.
Rochdale SMEE "Boiler Making," J. Clegg, Lea Hall, 7.30 p.m.
Malden SME bits and pieces.

December 7 Gauge 1 MRA annual meeting, MRC, Hammersmith, London.

SMEE MEETING

Colonel A. F. Marchment, a member of the SMEE, will give a talk entitled "Inspection Tests on Small Lathes," at Pepys House, Westminster, on Saturday.

The society extends an invitation to all model engineers in the vicinity to attend. Time of the meeting: 2.30 p.m.

Driving a model locomotive for the very first time is 13-year-old Terence Roberts, of Witney, Oxfordshire. He was given this opportunity at the open day of the North London SME (held at Arkley, near Barnet) following the disappearance of the official driver !

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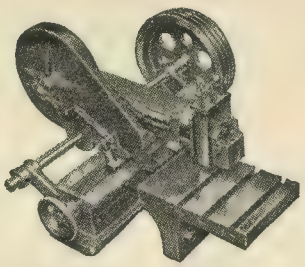

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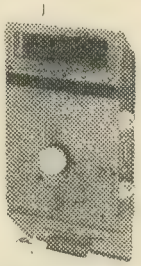

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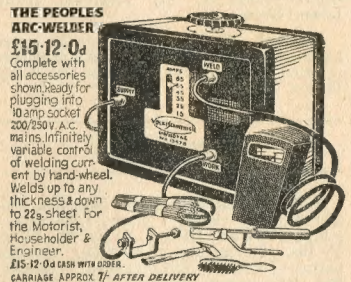
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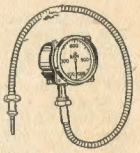

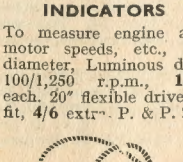

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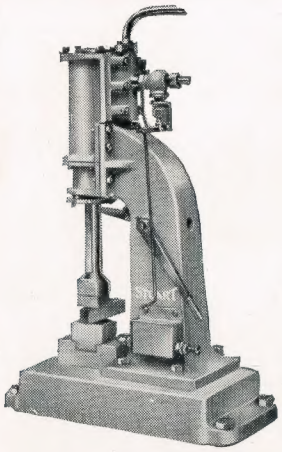

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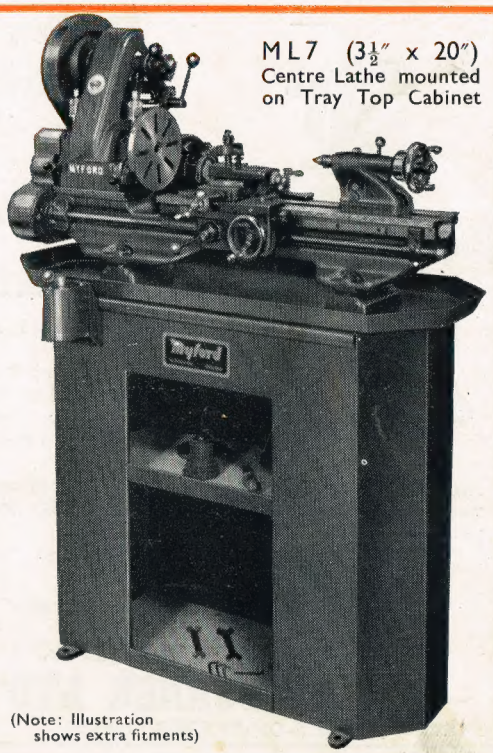

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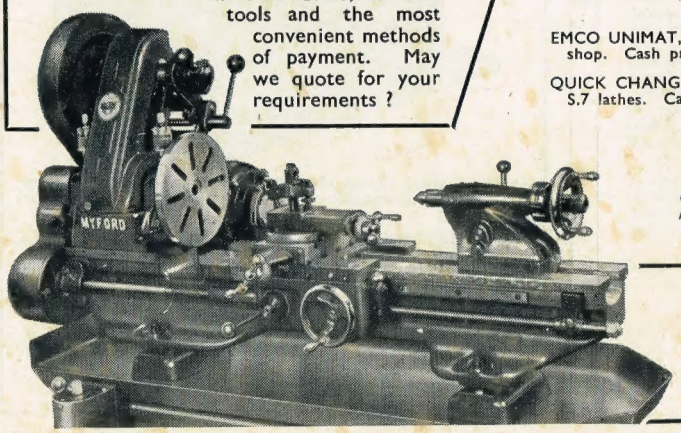

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